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China Report

SCIENCE AND TECHNOLOGY

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6 March 1985

CHINA REPORT
SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

CABINET REVISING SCIENCE-TECHNOLOGY PLAN

OW050521 Taipei CNA in English 0241 GMT 5 Feb 85

[Text] Taipei, 4 Feb (CNA)--The Executive Yuan said the draft project of science and technology development for the coming 10 years is being discussed and revised.

The Yuan made the statement in a written administrative report to the Legislative Yuan on Monday.

Among major sci-tech development programs, according to the report, the National Science Council will center its efforts on biological technology, electronic-optics technology and hepatitis research.

Other programs, such as those of automation, information, materials, semiconductor and HUF radar, are being carried out smoothly, the report points out.

It also discloses that a total of 1,221 research topics approved by a screening committee as eligible to receive subsidies in fiscal 1985 are also being aggressively carried out.

In another report, a survey by the Hsinchu science-based industrial park administration shows that more than 90 percent of surveyed manufacturing businesses in the park are willing to cooperate with military units in producing military items.

An official with the administration said Monday the result has been sent to agencies involved with the national effort in science and technology for their reference.

Monday's cabinet report to the legislature indicates that the industrial park has absorbed a total of U.S. \$50 million in the last half-year and the total amount of its exports and imports is U.S. \$180 million.

CSO: 4010/80

NATIONAL DEVELOPMENT

ELECTRONICS INDUSTRY SEEKS ADVANCED TECHNOLOGY

OW300809 Beijing XINHUA in English 0748 GMT 30 Jan 85

[Text] Beijing, 30 January (XINHUA)--China is to open up part of its domestic electronics market to foreign firms in exchange for imports or advanced technology, Electronics Industry Minister Jiang Zemin told a national conference which was opened here yesterday.

"The imported technology and equipment must be up-to-date and suited to China's needs," the minister said.

All forms of joint ventures and compensation trade would be encouraged to attract foreign technology and funds. He said the electronics industry should develop by directly adopting the world's latest scientific achievements, thus reducing the technological gap between China and other countries. From now on, various departments, enterprises and research institutes would be allowed to import electronics technology with their own funds and to enter joint projects abroad.

However, Jiang stressed that concentrated efforts should be made to digest and improve the imported technologies, in order to raise China's capability and self-reliance.

The special economic zones and coastal cities should make full use of their favorable conditions in importing advanced technologies and management methods, to help boost their electronics industries and provide their hinterlands with up-to-date information.

CSO: 4010/79

NATIONAL DEVELOPMENTS

GUANGDONG'S ELECTRONICS INDUSTRY RAPIDLY EXPANDS

HK130656 Guangzhou YANOCHEM WANBAO in Chinese 7 Feb 85 p 1

[Report by correspondents Li Junqiu [2621 0193 4428] and Lin Shi [2651 0670]: "The Output Value of the Electronics Industry of Guangdong Province has Quadrupled in Less Than 4 Years"]

[Text] In 1984 the growth rate of Guangdong's electronics industry was the highest in the country. Its industrial output value was 158 percent greater than that of the previous year. Now the output value it achieves in 1 month exceeds that it achieved during the whole year of 1978. In less than 4 years, starting from 1981, its gross output value has quadrupled. Now, on average, it can produce 1 television set in 2 minutes and 4 radio-recorders in a single minute.

In addition to a high growth rate, Guangdong's electronics industry has achieved rather good economic results. Last year the total amount of profits made by the industry as a whole was about 200 million yuan and prosperous plants with an annual income of "1 million yuan" or even "10 million yuan" emerged in great numbers. At the national meeting of directors of electronics industry offices and heads of electronics industry bureaus, Guangdong's delegate reported on the development of electronics industry in the province.

Guangdong's electronics industry has been developing at a moderate rate for a long time. In recent years its growth rate has become much higher because, with the advantage of its geographical proximity to Hong Kong and Macao, it has made conscious and vigorous efforts to import advanced facilities and advanced technologies from abroad. In the past few years it has imported from Hong Kong, Japan, the United States, Britain, and Italy a total of 155 production lines and more than 7,300 sets of facilities for producing color television sets, radios, electronic parts, electronic watches, and electronic toys. Most of these facilities are the products of the scientific and technological achievements made by foreign countries in the 1970's and some of them are of a technological level achieved by foreign countries in the 1980's. In addition, it has assimilated the facilities and technologies imported from abroad. In this way the production capacity and technological level of Guangdong's electronic industry has been rapidly raised. Now in the industry

most end-products are produced on the assembly line and the production of component parts is semiautomatic. All of the 68 prize-winning television sets at the fourth national meeting to compare and appraise the quality of television sets, which was held not long ago, used semiconductor components produced in Guangdong.

CSO: 4008/218

NATIONAL DEVELOPMENT

PRC SETS NEW RECORDS IN CHEMICAL INDUSTRY

OW251509 Beijing XINHUA in English 1446 GMT 25 Jan 85

[Text] Beijing, 25 January (XINHUA)--China's chemical industry in 1984 reported its highest-ever outputs of chemical fertilizer, synthetic ammonia, caustic soda, soda ash and tyres, with industrial output value hitting 45.8 billion yuan.

This was announced by Qin Zhongda, minister of chemical industry, at the opening session of a national conference here today.

Despite achievements made last year, Qin Zhongda said, the industry had difficulties and problems, including backward technology in some factories and unplanned imports.

Qin said his industry made a profit of six billion yuan in 1984, 10 percent more than the year before, with chemical fertilizer output reaching 14 million tons, synthetic ammonia, 18 million tons, caustic soda, 2.21 million tons, soda ash, 1.87 million tons, and 14 million sets of tyres.

Except soda ash, the outputs of eight main chemical products including fertilizers, tyres and pesticides exceeded the targets set for 1985 1 year ahead of schedule.

China invested 1.35 billion yuan in building key chemical projects. Construction on six of them has been accelerated, he said.

These included a chemical fertilizer factory in Shanxi Province and a paint factory in Beijing, Qin added.

Progress has also been made in preparation work for construction of two soda plants, one in Tianjin and the other in Lianyungang, the minister said.

Minister Qin said five projects had been put into operation last year, adding annual production capacity of 80,000 tons of butadienestyrene rubber, 25,000 tons of acrylic acid, 30,000 tons of acrylic products and more than 1,000 tons of neutral dyes and agents.

Specialists and technicians in the chemical industry developed 225 products and items of production technology last year, of which six, including a germicide and organic glass for aircraft, were awarded invention medals.

Headway was also made in importing technology. Chemical enterprises in Shanghai, Tianjin, Dalian and Jiangsu concluded 104 contracts for the import of technology last year.

Factories and enterprises have been given wider decision-making powers, and various forms of the economic responsibility system have been introduced, bringing more vitality to them.

Due to unplanned imports and high production costs, however, some chemical products could not find sufficient market, Qin said.

CSO: 4010/79

NATIONAL DEVELOPMENTS

SCIENCE IMPROVES OUTPUT, PROFITS IN HEILONGJIANG

0W111228 Beijing XINHUA in English 1201 GMT 11 Feb 85

[Text] Harbin, 11 Feb (XINHUA)--Sixty four major scientific innovations were applied to production in Heilongjiang Province in 1984, resulting in a 700 million yuan jump in profits, according to provincial officials.

Research departments in the province developed more than 2,000 technological innovations between 1979 and 1984. But before 1982, 85 percent were not applied.

To change the situation, the provincial authorities appropriated money to give awards to those people or units actively applying new technology.

In addition, a foundation was set up to provide funds for new technology application.

After this was done, a great number of people set to work to apply new technology to production processes. Last year, over 100 units and individuals received awards from the State Economic Commission and Science and Technology Commission for their efforts in this field.

The technology for fast freezing of vegetables developed in 1981 was widely used in the province last year, bring profits of one million yuan.

In 1983 and 1984, the province earmarked four million yuan to popularize a dozen technological processes including use of a metal washing agent and a boiler scaling agent. This brought profits of about 13 million yuan.

Fifteen new agricultural techniques helped bring in an additional 1,475,000 tons of grain. The application of dry seedling cultivation and sparse planting of rice yielded an additional 200,000 tons of rice, valued at more than 100 million yuan.

Now some 40,000 people in Heilongjiang are specializing in applying new technology. They come from government institutes and research units and are organized into service groups. The groups run exchange meetings and advise urban and rural units as to what is available in advanced technology.

CSO: 4010/85

NATIONAL DEVELOPMENTS

SCIENCE ACADEMY TO COOPERATE WITH 3 PROVINCES

OWI30830 Beijing XINHUA in English 0816 GMT 13 Feb 85

[Text] Beijing, 12 Feb (XINHUA)--The Chinese Academy of Sciences has signed long-term scientific cooperation agreements with three provinces, two municipalities and an autonomous region as well as several economic departments.

They include Shanxi Province--China's largest coal producer, Sichuan Province--one of China's major grain producers, the Xinjiang Uygur Autonomous region which accounts for one-sixth of China's territory, Hunan Province--a major farming area in central-south China, Tianjin--north China's important port city, and Beijing--China's capital, and the ministries of petroleum and coal industries.

China's national natural science research complex, the academy, has 119 institutes with 44,000 scientists and researchers.

In 1983 and 1984, the academy disseminated some 1,100 research findings, including technologies relating to energy development, computer application, software development and biological engineering.

An official of the academy said the academy was reforming its research management system, granting more decision-making power to subordinate institutes and encouraging closer cooperation with local authorities enterprises and universities.

Under an agreement signed with Hunan Province last December, the academy will disseminate findings suited to local economic development and the tapping of natural resources. The two parties will also establish a technology development company and exchange technical information.

The academy has also provided 38 research findings related to coal mining and agricultural development for Shanxi Province.

Cooperation between the academy and Sichuan Province focuses on the surveying and development of natural resources in the Panzhihua area--an iron and steel center.

To meet the demands of industrial development in Tianjin, the academy will help the city with technologies involving computer use, software development and biological engineering.

The academy's 35 institutes are working on 140 research projects in cooperation with 28 departments under the Ministry of the Petroleum Industry. The two parties' joint evaluation of the Kekya oilfield in Xinjiang has led to the discovery of new oil deposits there.

In addition, the academy has long-term cooperation with the Petroleum Ministry in studying petroleum, geology, oil drilling, and collection and transport of crude oil.

According to an agreement with the Ministry of the Coal Industry, the academy will investigate underground water resources in four coal mines in central and northern Shanxi Province.

Its institutes in Jilin Province, northeast China, have helped local enterprises make a combined profits of 300 million yuan (about 107 million U.S. dollars) in the past two years.

In 1984, the academy achieved some 1,000 scientific findings and 14 of them were given awards. Its research institutes have set up 70 technology development companies jointly with local enterprises or economic departments, giving a fresh impetus to the industrial development in various localities.

CSO: 4010/85

NATIONAL DEVELOPMENTS

HENAN SECRETARY ATTENDS MEETING TO APPOINT SCIENTIFIC ADVISER

HK209755 Zhengzhou Henan Provincial Service in Mandarin 1030 GMT 28 Jan 85

[Excerpts] The province held a meeting today at the Henan People's Hall on inviting Professor Hua Luogeng to serve as special adviser on the province's science and technology, as well as for Professor Hua Luogeng to make a speech on the mathematical theory and application of planned economy.

The meeting was attended by leading comrades of the provincial party and government, including Liu Jie, Liu Zhengwei, He Zhukang, Zhao Wenfu, Wang Huayun, Lin Yinghai, Qin Kecai, Li Baoguang, Chen Bingzhi, Guo Peijun, Hu Tingji, Ji Hanxing and (Hu Shiyin). Also present were Wang Ze, head of Advisory Committee of Nei Mongol Autonomous Region; (Guan Zhou), head of Economic Administrative Center of the State Economic Commission; Baoyan Batu, vice chairman of Nei Mongol Autonomous Regional CPPCC; and so on. More than 3,000 people from various circles of the provincial capital attended the speech session.

At the invitation ceremony, Comrade He Zhukang, acting on behalf of the provincial CPC committee, the provincial government and the people in Henan, first warmly welcomed Professor Hua Luogeng.

Comrade Hu Zhukang said: Professor Hua Luogeng is a world-known scientist. He is also the outstanding mathematician who first applied mathematics to production and to building China's national economy. On several occasions, Professor Hua has led small groups to the province for popularizing optimization and overall planning, achieving fruitful results. This kind of selfless and fearless spirit, and attitude of respecting science is unforgettable. Now, it is an honor of Henan's people as Professor Hua Luogeng has agreed to serve as special adviser on the province's science and technology. We ardently hope that Professor Hua will visit the province more frequently.

At 0940, Professor Hua Luogeng solemnly received a letter of appointment from Comrade He Zhukang at the rostrum. He was so excited that he held firmly the hands of Comrade He Zhukang.

After that, Professor Hua Luogeng made a speech entitled: The Mathematical Theory and Application of Planned Economy.

CSO: 4008/200

NATIONAL DEVELOPMENTS

BEIJING AUTHORITIES RECEIVE EXPERT ADVICE

OW061750 Beijing XINHUA in English 1622 GMT 6 Feb 85

[Text] Beijing, 6 Feb (XINHUA)--Beijing's local authorities are receiving advice from more than 1,100 technical experts, chairman of the city's Scientific and Technological Committee Chen Shengwu told a meeting here yesterday.

The municipal government had set up 61 consultative groups of technical experts, mostly professors and senior engineers, by the end of 1984.

In addition, more than 7,000 technicians had also been invited to advise on development in suburban districts and countries.

The Beijing rice advisory group, which was formed six years ago, now consists of 13 technical advisers.

The group has developed a water-saving rice cultivation method, which is suitable for growing good-quality rice in northern China, and this has been introduced to 40 percent of the spring rice paddies in Beijing area.

With the help of the Beijing Mining Administration, senior engineer Liu Tianquan of the Beijing Coal Mining Academy, and his colleagues have solved technical problems related to coal extraction underneath major buildings, roads and rivers.

At yesterday's annual meeting to discuss the work of technical advisors, Mayor Chen Xitong said Beijing attached great importance to their role.

CSO: 4010/83

NATIONAL DEVELOPMENTS

NEW PATENT MAGAZINE TO BE PUBLISHED IN HONG KONG

OW011250 Beijing XINHUA in English 1236 GMT 1 Feb 85

[Text] Hong Kong. 1 Feb (XINHUA)--A new magazine "Chinese Patents and Trademarks," will begin publication in both Chinese and English here in April.

The magazine, the first of its kind for China, will help foreigners get an understanding of Chinese laws and regulations on the subject, said Liu Gushu, editor-in-chief of the magazine and general manager of the China Patent Agency (Hong Kong) Ltd.

The first issue will carry comments on China's patent law by Chinese jurists and instructions about how foreigners can apply for Chinese patents. It will also carry the full text of the patent law, which will come into force on 1 April. Detailed regulations for the implementation of the law will also be published.

Liu said that his agency had received 170 letters from foreigners applying for patents in China. He estimated the number would reach 1,000 by the end of the year.

He disclosed that China will become a member of the Paris Convention for the Protection of Industrial Property on 19 March.

CSO: 4010/83

NATIONAL DEVELOPMENTS

IMPLEMENTING REGULATIONS FOR PRC PATENT LAW

HK060807 Beijing CHINA DAILY in English 2-3, 5-6 Feb 85 p 2

[*"Implementing Regulations" of the patent law approved by the State Council and promulgated by the Patent Office of the People's Republic of China on 19 January--published in four installments*]

[Text] Chapter I

General Provinces

Rule 1. These Implementing Regulations are drawn up in compliance with the provisions of Article 68 of the Patent Law of the People's Republic of China (hereinafter referred to as "the Patent Law").

Rule 2. "Invention" in the Patent Law means any new technical solution relating to a product, a process or improvement thereof.

"Utility model" in the Patent Law means any new technical solution relating to the shape, the structure, or their combination, of a product, which is fit for practical use.

"Design" in the Patent Law means any new design of the shape, pattern, color, or their combination, of a product, which creates an aesthetic feeling and is fit for industrial application.

Rule 3. Any proceedings provided for by the Patent Law and these implementing Regulations shall be conducted in a written form.

Rule 4. Any document submitted under the Patent Law and these implementing Regulations shall be in Chinese. The standard scientific and technical terms shall be used if there is a prescribed one set forth by the State. Where no generally accepted translation in Chinese can be found for a foreign name or scientific or technical term, the one in the original language shall also be indicated.

Where any certificate or certified document which is submitted in accordance with the Patent Law or these Implementing Regulations is in a foreign language, the Patent Office may request a Chinese translation to be also submitted within a specified time limit.

Rule 5. For any document sent by mail by the Patent Office to the addressee residing in any of the municipalities under the people's governments of provinces or autonomous regions, or above, the 8th day from the date of mailing, or to the addressee residing in any of the other places in China, the 16th day from the date of mailing, shall be presumed to be the receiving date.

For any document sent to the Patent Office by the applicant by mail in China, the date of mailing indicated by the postmark shall be the date of filing. If the date of mailing indicated by the postmark on the envelope is not readable, the date on which the Patent Office receives the document shall be presumed to be the date of filing, except where the date of mailing is provided by the applicant.

Rule 6. The first day of any time limit prescribed in the Patent Law or these Implementing Regulations shall not be counted. Where a time limit is counted by year or by month, it shall expire on the corresponding day of the last month; if there is no corresponding day in that month, the time limit shall expire on the last day of that month.

If a time limit expires on an official holiday, the time limit shall expire on the first working day after that official holiday.

Rule 7. Where a time limit prescribed in the Patent Law or these Implementing Regulations or specified by the Patent Office is not met because of force majeure or any other justified reason, the applicant, the patentee or any other interested party may, within one month from the day on which the impediment is removed, state the reasons and request for an extension of the time limit, with the exception of the time limits prescribed in Article 24, Article 29, the first sentence of Article 41, Article 45 and Article 61 of the Patent Law.

Before the expiration of any time limit specified by the Patent Office, an applicant who, on the basis of a justified reason, wishes to have the time limit extended may make a request, accompanied with relevant proof, to the Patent office.

Rule 8. Where the invention-creation for which a patent is applied for by the entity of the national defense system relates to the security of the State and is required to be kept secret, the application for patent shall be filed with the patent organization set up by the competent department of science and technology of national defense. The Patent Office shall make a decision on the basis of the observations on the examination of the application presented by the said patent organization.

Rule 9. Subject to the preceding rule, the Patent Office, after receiving an application for patent which is required to be examined for the purpose of security, shall send it to the competent department concerned of the State Council for examination. The said department shall, within four months from the receipt of the application, send a report on the results of the examination to the Patent Office. Where the invention-creation for which a patent is applied for is required to be kept secret, the Patent Office shall handle it as a secret application for patent and notify the applicant accordingly.

Rule 10. "Service invention-creation, made by a person in execution of the tasks of the entity to which he belongs" in Article 6 of the Patent Law refers to any invention-creation made:

- (1) in the course of performing his own duty;
- (2) in the execution of any task, other than his own duty, which was entrusted to him by the entity to which he belongs;
- (3) within one year from his resignation, retirement or change of work, where the invention-creation relates to his own duty or the other task entrusted to him by the entity to which he previously belonged.

"Material means of the entity" in Article 6 of the Patent Law refers to the entity's money, equipment, spare parts, raw materials, or technical data which are not to be disclosed to the public.

Rule 11. "Inventor" or "creator" in the Patent Law refers to any person who has made creative contributions to the substantive features of the invention-creation. Any person who, during the course of accomplishing the invention-creation, is responsible only for organization work, or who offers facilities for making use of material means, or who takes part in other auxiliary functions, shall not be considered as inventor or creator.

Rule 12. Two or more applicants who file, on the same day, applications for patent for the identical invention-creation, as provided for in Article 9 of the Patent Law, shall, after receiving a notification from the Patent Office, hold consultation among themselves to decide the person or persons who shall be entitled to file the application.

Rule 13. The patentee who has concluded any license contract for exploitation of the patent with an entity or individual shall, within three months from the entry into force of the contract, submit the contract to the Patent Office for record.

Rule 14. "The Patent Agency" in Article 19, paragraph 1, and Article 20, of the Patent Law refers to the China Council for the Promotion of International Trade, the Shanghai Patent Agency, the China Patent Ltd, and other patent agencies designated by the State Council.

Rule 15. Any applicant who appoints a patent agency for filing an application for a patent with, or for dealing with other patent matters before, the Patent Office, shall submit a power of attorney indicating the scope of the power entrusted.

Chapter II

Application for Patent

Rule 16. Anyone who applies for a patent shall submit application documents in duplicate.

Rule 17. "Other related matters" in Article 26, paragraph 2, of the Patent Law refers to:

- (1) the nationality of the applicant;
- (2) where the applicant is an enterprise or other organization, the name of the country in which the applicant has the principal business office;
- (3) where the applicant has appointed a patent agency, the name and address of the patent agency and the name of the patent agent;
- (4) where the applicant is an entity, the name of its representative;
- (5) where the priority of an earlier application is claimed, the relevant matters which should be indicated;
- (6) the signature or the seal of the applicant;
- (7) a list of the documents constituting the application;
- (8) a list of the documents appending the application.

Where there are two or more applicants and where they have not appointed a patent agency, they shall designate a common representative is designated, the applicant first named in the request shall be considered as the common representative.

Where an application for a patent for design is filed, the request shall, when necessary, also contain a brief description of the design.

Rule 18. Except where the nature of the invention or utility model calls for a different type and order of presentation, the description of an application for a patent for invention or utility model shall, in the following order:

- (1) state the title of the invention or utility model as appearing in the request;
- (2) specify the technical fields to which the invention or utility model relates,
- (3) indicate the prior art which, as far as known to the applicant, can be regarded as useful for the understanding, searching and examination of the invention or utility model, and cite the documents reflecting such art;
- (4) specify the task which the invention or utility model is designed to fulfill;
- (5) disclose the invention or utility model in a manner sufficiently clear and complete so as to enable a person having ordinary skill in the art to carry it out;

- (6) state the merits or effective results of the invention or utility model as compared with the prior art;
- (7) briefly describe the figures in the drawings, if any;
- (8) describe in detail the best mode contemplated by the applicant for carrying out the invention or utility model, with reference to the drawings, if any.

The description of the invention or utility model may contain chemical or mathematical formulae but no commercial advertising.

Rule 19. The same sheet of drawings may contain several figures of the invention or utility model. The figures shall be numbered consecutively in Arabic numerals and arranged in numerical order.

The scale and the distinctness of the drawings shall be such that a reproduction with a linear reduction in size to two-thirds would still enable all details to be clearly distinguished.

Reference signs used in the drawings of an application shall be consistent throughout. Reference signs not appearing in the description of the invention or utility model shall not appear in the drawings.

The drawings shall not contain any other explanatory notes, except words which are indispensable.

Rule 20. The claims shall define clearly and concisely the matter for which protection is sought in terms of the technical features of the invention or utility model.

If there are several claims, they shall be numbered consecutively in Arabic numerals.

The technical terminology used in the claims shall be consistent with that used in the description. The claims may contain chemical or mathematical formulae but no drawings. They shall not, except where absolutely necessary, contain such references to the description or drawings "as described in part... of the description," or "as illustrated in figure...of the drawings."

Rule 21. Claims may be independent or dependent.

An independent claim shall outline the essential technical contents of an invention or utility model and describe the indispensable technical features constituting the invention or utility model.

A dependent claim relying on the reference to one or more other claims shall refer only to the preceding claim or claims.

Rule 22. Except where the nature of the invention or utility model calls for other forms of expression, an independent claim shall be presented in the following form:

(1) a preamble portion, indicating the technical field to which the invention or utility model pertains and the technical features of the prior art which relate closely to the subject matter of the invention or utility model;

(2) a characterizing portion, stating, in such words as "the invention (or utility model) is characterized in that...." or in similarly concise expressions, the technical features of the invention or utility model, which, in combination with the features stated in the preamble portion, it is desired to protect.

Each invention or utility model shall have only one independent claim, which shall precede all the dependent claims relating to the same invention or utility model.

Rule 23. Except where the nature of the invention or utility model calls for other forms of expression, a dependent claim shall be presented in the following form:

(1) a reference portion, indicating the serial number(s) of the claim(s) referred to. Where possible, the reference to the serial number shall be placed at the beginning of the claim(s);

(2) a characterizing portion, which, by stating the additional technical features of the invention or utility model, further defines the technical features cited in the reference portion.

Dependent claims referring to more than two other claims shall not serve as basis for any other multiple dependent claims.

Rule 24. The abstract shall indicate the technical field to which the invention or utility model pertains, the technical problems to be solved, the essential technical features and the use or uses of the invention or utility model. The abstract may, where applicable, contain the chemical formula or the figure which best characterizes the invention or utility model. The whole text of the abstract shall contain preferably not more than 200 words.

Rule 25. Where an application for a patent for invention concerns a micro-biological process or a product thereof and involves the use of a micro-organism which is not available to the public, the applicant shall, in addition to the other requirements provided for in the Patent Law and these Implementing Regulations,

(1) deposit a sample of the micro-organism with a depositary institution designated by the Patent Office before the date of filing or, at the latest, on the date of filing;

(2) give in the application document relevant information of the characteristics of the micro-organism;

(3) indicate in the request the scientific name (with its Latin name) and the name of the depositary institution, the date on which the sample of the

micro-organism was deposited and the file number of the deposit, and submit a receipt of deposit from that institution.

Rule 26. After the publication of an application for a patent for invention relating to a micro-organism, any entity or individual which or who intends to make use of the micro-organism mentioned in the application for the purpose of experiment shall make a request to the Patent Office containing the following:

- (1) the name and address of the entity or individual making the request;
- (2) an undertaking by the entity or individual making the request not to make the micro-organism available to any other person;
- (3) an undertaking to use the micro-organism for experimental purpose only before the grant of the patent right.

Rule 27. The size of drawings or photographs of a design submitted in accordance with the provisions of Article 27 of the Patent Law shall not be smaller than 3cm x 8cm, nor larger than 19cm x 27cm.

The applicant may submit for each design one or more drawings or photographs of different angles, sides or positions so as to clearly show the object for which protection is sought. The applicant shall indicate on each drawing or photograph the angle, side or position, and mark on the top left and right of the back of drawing or photograph its consecutive number and the name of the applicant.

Rule 28. Where an application for a patent for design seeking protection of colors is filed, a drawing or photograph in color, and a drawing or photograph in white and black, shall be submitted, and a statement of the colors for which protection is sought shall be made on the drawing or photograph in white and black.

Rule 29. Where the Patent Office finds it necessary, it may require the applicant for a patent for design to submit a sample or model of the product incorporating the design. The volume of the sample or model submitted shall not exceed 30cm x 30cm x 30cm, and its weight shall not surpass 15 kilos. Articles easy to get rotten or broken, or articles that are dangerous may not be submitted as sample or model.

Rule 30. Academic or technological meetings mentioned in item (2) of Article 24 of the Patent Law mean any academic or technological meeting organized by a competent department concerned of the State Council or by a national academic or technological association.

Rule 31. Where any application for a patent falls under the provisions of item (1) or item (2) of Article 24 of the Patent Law, the applicant shall, when filing the application, make a declaration and, within a time limit of two months from the date of filing, submit a certificate issued by the entity which organized the international exhibition or academic or technological meeting, stating that the invention-creation was in fact exhibited or made public there and also the date of its exhibition or making public.

Where any application for a patent falls under the provisions of item (3) of Article 24 of the Patent Law, the Patent Office may, when necessary, require the applicant to submit the relevant proof.

Rule 32. Where the applicant for a patent for invention claims priority, it or he shall, within 15 months from the date on which it or he first filed the application in a foreign country, submit the filing number accorded by that country.

Rule 33. Where two or more priorities are claimed for an application for a patent, the priority period for the application shall be calculated from the earliest priority date.

Rule 34. Where an application for a patent is filed by any foreigner, foreign enterprise or other foreign organization having no habitual residence or business office in China, the Patent Office may, when there is doubt, require the applicant to submit the following documents:

- (1) a certificate concerning the nationality of the applicant;
- (2) a certificate concerning the seat of the headquarters of a foreign enterprise or other foreign organization;
- (3) a testimonial showing that the country, to which the foreigner, foreign enterprise or other foreign organization belongs, recognizes that Chinese citizens or entities are, under the same conditions applied to its nationals, entitled to patent rights and other related rights in that country.

Rule 35. According to the provisions of Article 31, paragraph 1, of the Patent Law, the claims in an application for a patent for invention or utility model may be any of the following:

- (1) two or more independent claims of the same category (product or process) which cannot be included in one claim;
- (2) an independent claim for a product and an independent claim for a process specially adapted for the manufacture of the product;
- (3) an independent claim for a product and an independent claim for a use of the product;
- (4) an independent claim for a product, an independent claim for a process specially adapted for the manufacture of the product, and an independent claim for a use of the product;
- (5) an independent claim for a product, an independent claim for a process specially adapted for the manufacture of the product, and an independent claim for an apparatus specially designed for carrying out the process;
- (6) an independent claim for a process and an independent claim for an apparatus specially designed for carrying out the process;

(7) an independent claim for a process and an independent claim for a product directly manufactured by carrying out the process.

Rule 36. Where an application for a patent for design contains two or more designs in accordance with the provision of Article 31, paragraph 2, of the Patent Law, the designs shall be numbered consecutively and the products incorporating the designs shall be indicated in the request of the application. The consecutive numbers shall be marked on the bottom left of the back of the drawings or photographs of the design.

Rule 37. When withdrawing an application for a patent the applicant shall submit to the Patent Office a declaration stating the title of the invention-creation, the filing number and the date of filing.

Where a declaration to withdraw the application for a patent is submitted after the printing preparation has been done by the Patent Office for publication of the application documents, the application shall be published as scheduled.

Chapter III

Examination and Approval of Application for Patent

Rule 38. In any of the following situations, an examiner or a member of the Patent Reexamination Board shall, on his own initiative or upon the request of the applicant or any other interested party, be excluded from exercising his function.

- (1) where he is a close relative of the applicant or the patent agent;
- (2) where he has an interest in the application for patent;
- (3) where he has such other kinds of relations with the applicant or the patent agent that might influence the impartial examination of the application.

Where a member of the Patent Reexamination Board has taken part in the examination of the application, the provisions of the preceding paragraph shall apply.

Rule 39. Upon the receipt of a request, a description (a drawing being indispensable for utility model) and one or more claims for an application for a patent for invention or utility model, or a request and one or more drawings or photographs showing the design for an application for a patent for design, the Patent Office shall accord the date of filing and a filing number, and it shall notify them to the applicant.

Rule 40. If the application documents submitted do not contain a request or a description or claims, or if they are not in conformity with the provisions of Article 27 of the Patent Law, the Patent Office shall declare the application unacceptable and notify the applicant accordingly.

Rule 41. Where the description of an invention mentions that it contains "explanatory notes to the drawings" but the drawings are missing, the applicant shall, within the time limit specified by the Patent Office, either furnish the drawings or make a declaration for the delegation of the "explanatory notes to the drawings." If the drawings are submitted later, the date of their delivering at, or mailing to, the Patent Office shall be the date of filing of the application; if the mention of "explanatory notes of the drawings" is to be deleted, the initial date of filing shall be the date of filing of the application.

Rule 42. Where an application for a patent contains two or more inventions, utility models or designs, the application may, at any time before the announcement of the application under Article 39 or Article 40 of the Patent Law, or after the said announcement at the time when the Patent Office considers the filing of a divisional application is justified, submit to the Patent Office a request for the division of the application and divide it on its or his own initiative into several applications.

If the Patent Office finds that the application for a patent is not in conformity with the provisions of Article 31 of the Patent Law and Rule 35 of these Implementing Regulations, it shall invite the applicant to divide the application within the specified time limit. If, without any justified reason, the applicant does not make any response within the time limit, the application shall be deemed to have been withdrawn.

Rule 43. Divisional applications filed in accordance with Rule 42 of these Implementing Regulations may enjoy the date of filing of the initial application, provided that they do not go beyond the scope of disclosure contained in the initial description.

Rule 44. Where, upon preliminary examination, the Patent Office finds that the application for a patent obviously falls under Article 5 or Article 25 of the Patent Law, or is obviously not in conformity with Article 18 or Article 19 of the Patent Law or Rule 2 of these Implementing Regulations, it shall invite the applicant [as published] to present its or his observations within a specified time limit. If the applicant, without any justified reason, fails to meet the time limit for presenting observations, the application shall be deemed to have been withdrawn.

Where, after the applicant has made the observations, the Patent Office still finds that the application is obviously not in conformity with the provisions of the articles and the rule cited in the preceding paragraph, the application shall be rejected.

Rule 45. Where the application for patent has any of the following deficiencies, the applicant shall, within the time limit specified by the Patent Office, correct it:

- (1) The request is not presented in the prescribed form or the indications therein are not in conformity with the requirements;

- (2) The description and its drawings or the claims of the invention or utility model are not in conformity with the relevant provisions;
- (3) The application for a patent or invention or utility model does not contain an abstract;
- (4) The drawings or photographs contained in the application for a patent for design are not in conformity with the relevant provisions;
- (5) Where a patent agency is appointed, no power of attorney is submitted;
- (6) Any other deficiencies which call for correction.

If the applicant, without any justified reason, fails to meet the time limit for correcting the deficiencies, the application shall be deemed to have been withdrawn. If, after the correction, the application is still not in conformity with the relevant provisions of the Patent Law or these Implementing Regulations, it shall be rejected.

Rule 46. Where the applicant requests for an earlier publication of its or his application for a patent for invention a declaration shall be made to the Patent Office. The Patent Office shall, after preliminary examination of the application and unless it is to be rejected, publish it immediately.

Rule 47. The applicant shall, when indicating in accordance with Article 27 of the Patent Law the product incorporating the design and the class to which that product belongs, refer to the classification of products for designs published by the Patent Office. Where no indication, or an incorrect indication, of the class to which the product incorporating the design belongs is made, the Patent Office may supply the indication or correct it.

Rule 48. Any person may, from the date of publication of an application for a patent for invention till the date of the announcement of the preliminary approval after examination as to substance, submit to the Patent Office observations, with the reasons therefor, on the application which is not in conformity with the provisions of the Patent Law.

Rule 49. Where the applicant for a patent for invention cannot furnish, for justified reason, the documents concerning any search or the results of any examination under Article 36 of the Patent Law, it or he shall make a statement to that effect and submit them when the said documents and results are available.

Rule 50. The Patent Office shall, when proceeding on its own initiative to examine an application for a patent for invention in accordance with the provisions of Article 35, paragraph 2, of the Patent Law, notify the applicant accordingly.

Rule 51. Within a period of 15 months from the date of filing, or at the time when a request for examination as to substance is made, or when a response is made in regard to an opposition, the applicant for a patent for

invention may amend the description and the claims of the applicant for a patent for invention on its or his own initiative.

When an amendment of the description and the claims in an application for a patent for invention or utility model is made, a replacement sheet in prescribed form shall be submitted, unless the amendment concerns only the alteration, insertion or deletion of a few words.

Rule 52. The applicant for a patent for utility model or design may, within a period from the date of filing till the date of announcement of the application for patent, or at the time when a response is made in regard to an opposition amend its or his application on its or his own initiative. Where an amendment to an application for a patent for design is made, it shall not change the essential elements of the design.

Rule 53. The situations where an application for patent shall be rejected by the Patent Office shall comprise the following:

- (1) Where the applicant does not comply with the provisions of Article 3 of the Patent Law and Rule 2 of these Implementing Regulations;
- (2) Where the applicant falls under the provisions of Article 5 or Article 25 of the Patent Law, or it does not comply with the provisions of Article 22 or Article 23 of the Patent Law;
- (3) Where the applicant has no right to apply for a patent according to the provisions of Article 6, Article 8 or Article 18 of the Patent Law, or cannot obtain a patent right according to the provisions of Article 9 of the Patent Law;
- (4) Where the applicant does not comply with the provisions of Article 26, paragraph 3 or paragraph 4, or Article 31 of the Patent Law;
- (5) Where the amendments to the application or the divisional applications go beyond the scope of disclosure contained in the initial description.

Rule 54. The situations where an opposition may be filed under Article 41 of the Patent Law with regard to an application for a patent for invention or utility model, which is announced by the Patent Office, shall comprise the following:

- (1) where the invention for which a patent is applied for does not comply with the provisions of Article 3 of the Patent Law and rule 2, paragraph 1, of these Implementing Regulations, or the utility model for which a patent is applied for does not comply with the provisions of Article 3 of the Patent Law and Rule 2, paragraph 2, of these Implementing Regulations;
- (2) where the application falls under the provisions of Article 5 or Article 25 of the Patent Law, or it does not comply with the provisions of Article 22 of the Patent Law;

(3) where the applicant has no right to apply for a patent according to Article 6, Article 8 or Article 18 of the Patent Law, or the essential elements of an application have been taken from the descriptions, drawings, models, equipment, etc., of another person, or from a process used by another person, without his consent;

(4) where the application does not comply with the provisions of Article 26, paragraph 3 or paragraph 4 of the Patent Law;

(5) where the amendments to the application or the divisional applications go beyond the scope of the disclosure contained in the initial description.

Rule 55. The situations where an opposition may be filed under Article 41 of the Patent Law with regard to an application for a patent for design, which is announced by the Patent Office, shall comprise the following:

(1) where the design for which a patent is applied for does not comply with the provisions of Article 3 of the Patent Law and Rule 2, paragraph 3, of these Implementing Regulations;

(2) where the design for which a patent is applied for falls under the provisions of Article 5 of the Patent Law, or does not comply with the provisions of Article 23 of the Patent Law;

(3) where applicant has no right to apply for a patent according to Article 6, Article 8 or Article 18 of the Patent Law, or cannot obtain a patent right according to Article 9 of the Patent Law, or the essential elements of the design have been taken from the designs, drawings, photographs, articles or models of another person without his consent;

(4) where the amendments to the application has changed the essential elements of the design.

Rule 56. Anyone who files an opposition in accordance with the provisions of Article 41 of the Patent Law shall submit the opposition, with the reasons therefor, in duplicate to the Patent Office.

Rule 57. After the receipt of the opposition, the Patent Office shall make an examination of it. Where the opposition does not conform to the prescribed requirements, the Patent Office shall notify the opponent to rectify it within the specified time limit. If the opponent fails to rectify the opposition within the specified time limit, the opposition shall be deemed not to have been filed.

Where the reasons for opposition are not stated, or the reasons for opposition does not conform to the provisions of Rule 54 or Rule 55 of these Implementing Regulations, the opposition shall be declared to be unacceptable.

Rule 58. The Patent Reexamination Board shall consist of experienced technical and legal experts designated by the Patent Office. The Director General of the Patent Office shall be the Director of the board.

Rule 59. Where the applicant requests the Patent Reexamination Board to make a reexamination in accordance with the provisions of Article 43, paragraph 1, of the Patent Law, it or he shall file a request for reexamination and state the reasons therefor, together with the relevant supporting documents. The request and the supporting documents shall be in duplicate.

The applicant may amend its or his application for a patent at the time when it or he requests reexamination, but the amendment shall be limited only to the part to which the decision of rejection of the application relates.

Rule 60. Where the request for reexamination does not comply with the prescribed form, the person who made the request shall rectify it within the time limit fixed by the Patent Reexamination Board. If the rectification fails to be made within the time limit, the request for reexamination shall be deemed to have been withdrawn.

Rule 61. The Patent Reexamination Board shall send the request for reexamination which the Board has received to the examiner who has made the examination to make observations. The Patent Reexamination Board shall make a decision on the request and notify the applicant accordingly.

Rule 62. Where the Patent Reexamination Board finds after reexamination that the request does not comply with the provisions of the Patent Law, it shall invite the person who has made the request for reexamination to submit his observations within the specified time limit. If, without any justified reason, the time limit for making response is not met, the request for reexamination shall be deemed to have been withdrawn.

Rule 63. At any time before the Patent Reexamination Board makes its decision on the request for reexamination, the person who has made the request may withdraw his request for reexamination.

Rule 64. The Patent Office shall, after making a decision to grant the patent right, notify the applicant to pay a fee for a patent certificate within two months and claim it. Where the applicant fails to pay the fee within the time limit, it or he shall be deemed to have abandoned its or his right to obtain the patent right.

Chapter IV

Invalidation of Patent Right

Rule 65. Anyone making a request for invalidation or part invalidation of a patent right according to the provisions of Article 48 of the Patent Law shall submit the request, with the reasons therefor, to the Patent Reexamination Board. Where necessary, relevant documents shall be submitted. The request and the relevant documents shall be in duplicate.

Rule 66. Where the request for invalidation of the patent right does not comply with the prescribed form, the person who made the request shall rectify it within the time limit fixed by the Patent Reexamination Board.

If the rectification fails to be made within the time limit, the request for invalidation shall be deemed to have been withdrawn.

The provisions of Rule 54 or Rule 55 of these Implementing Regulations shall be applied so far as the reason for the request for invalidation of the patent right are concerned.

Where no reasons have been stated in the request for invalidation or where the reasons stated do not comply with the provisions of Rule 54 or Rule 55 of these Implementing Regulations, the request shall be declared to be unacceptable.

Rule 67. The Patent Reexamination Board shall send a copy of the request for invalidation of the patent right and a copy of the relevant documents to the patentee and invite it or him to present its or his observations within a specified time limit. Where, without any justified reason, no response is made within the time limit, the patentee shall be deemed to have no objection to make.

Chapter V

Compulsory License for Exploitation for Patent

Rule 68. Any entity requesting, in accordance with the provisions of Article 52 of the Patent Law, or any patentee requesting, under Article 53 of the Patent Law, a compulsory license for exploitation of a patent for invention or utility model, shall submit to the Patent Office a request for compulsory license, and supporting documents to show that it or he has not been able to conclude with the patentee a license contract for exploitation on reasonable terms. The request and the supporting documents shall be in duplicate.

An entity requesting, in accordance with the provisions of Article 52 of the Patent Law, a compulsory license for exploitation of a patent for invention or utility model, shall at the same time furnish documents in duplicate to show that it is in a position to exploit the patent.

The Patent Office shall, after the receipt of the request for compulsory license, invite the patentee concerned to present its or his observations within the specified time limit, where, without any justified reason, no response is made within the time limit, the patentee shall be deemed to have no objection to make.

The Patent Office shall, after having examined the request for compulsory license and the observations of the patentee, make a decision and notify the entity or patentee which made the request and the patentee concerned.

Rule 69. Any entity or individual, or any patentee, requesting, in accordance with the provisions of Article 57 of the Patent Law, the Patent Office to adjudicate the fees for exploitation, shall submit a request for an adjudication and furnish documents showing that the parties have not been able to conclude an agreement in respect to the amount of the fees. The Patent

Office shall, after the receipt of the request, make an adjudication within three months and notify the parties accordingly.

Chapter VI

Rewards To Inventor or Creator of Service Invention-Creation

Rule 70. "Rewards" mentioned in Article 16 of the Patent Law includes money prizes and remunerations which are to be awarded to inventors and creators.

Rule 71. Any entity holding a patent right shall, after the grant of the patent right, award to inventors or creators of a service invention-creation a sum of money as prize. The sum of money prize for a patent for invention shall not be less than 200 yuan; the sum of money prize for a patent for utility model or design shall not be less than 50 yuan.

Where an invention-creation was made on the basis of an inventors or creators proposal adopted by the entity to which he belongs, after the grant of the patent right, the entity holding it shall award to him a money prize liberally.

Any enterprises holding the patent right may include the said money prize into its production cost; and institution holding the patent right may disburse the said money prize out of its operating expenses.

Rule 72. Any entity holding a patent right shall, after exploiting the patent or invention-creation within the duration of the patent right, draw each year from any increase in profits after taxation a percentage of 0.5 percent--2 percent due to the exploitation of the invention or the utility model, or a percentage of 0.05 percent--0.2 percent due to the exploitation of the design, and award it to the inventor or creator as remuneration. The entity shall, otherwise, by making reference to the said percentage, award a lump sum of money to the inventor or creator as remuneration.

Rule 73. Where any entity holding a patent right for invention-creation authorizes other entities or individuals to exploit its or his patent, it shall, after taxation, draw a percentage of 5 percent--10 percent from the fees for exploitation it received and award it to the inventor or creator as remuneration.

Rule 74. The remuneration provided for in this chapter shall all be disbursed out of the profits derived from the making of patented products or the use of patented process and out of the fees obtained for the exploitation of the patents. The remuneration shall not be included in the normal bonus fund of the entity, nor subject to the bonus tax. But the inventor or creator shall pay tax for his income.

Rule 75. The Chinese entities under collection ownership and other enterprises may award to the inventor or creator money prize and remuneration by making reference to the provisions in this chapter.

Chapter VII

Administrative Authority for Patent Affairs

Rule 76. "The administrative authority for patent affairs" in Article 60 of the Patent Law and in these Implementing Regulations refers to the administrative authority for patent affairs set up by the competent departments concerned of the State Council, and the people's governments of the provinces, autonomous regions, municipalities directly under the Central Government, open cities and special economic zones.

Rule 77. Where, after the publication of an application for a patent for invention and before the grant of the patent right, any entity or individual has exploited the invention without paying appropriate fees, the patentee may, after the grant of the patent right, request the administrative authority for patent affairs to intervene in the matter, or may directly institute legal proceedings in the people's court. The administrative authority for patent affairs intervening in the matter shall have the power to decide that the entity or individual shall pay appropriate fees within the specified time limit. Where any of the parties concerned is not satisfied with the decision of the said authority, it or he may institute legal proceedings in the people's court.

The provisions of the preceding paragraph shall apply mutatis mutandis in respect of the application for a patent for utility model or design.

Rule 78. Where any dispute arises between any inventor or creator, and the entity to which he belongs, as to whether an invention-creation is a service invention-creation, or whether an application for a patent is to be filed in respect of a service invention-creation, the inventor or creator may request the competent department at the higher level or the administrative authority for patent affairs of the region in which the entity is located to handle the matter.

Rule 79. Where parties to any transdepartmental or transregional infringement dispute request the administrative authority for patent affairs to handle the matter, the said dispute shall be handled by the administrative authority for patent affairs of the region in which the infringement has arisen, or by the administrative authority for patent affairs of the higher competent department of the infringing entity.

Chapter VIII

Patent Register and Patent Gazette

Rule 80. The Patent Office shall maintain a Patent Register in which shall be recorded the following matters relating to any patent right:

Rule 81. The Patent Office shall publish the Patent Gazette at regular intervals, publishing or announcing the following:

(1) the bibliographic data contained in the request of an application for a patent;

(2) the abstract of the description of an invention or utility model;

(3) any request for examination as to substance of an application for a patent for invention and any decision made by the Patent Office to proceed on its own initiative to examine as to substance an application for a patent for invention;

(4) the preliminary approval after examination of an application for a patent for invention and the announcement of the application for patent for utility model or design;

(5) any rejection of an application for a patent;

(6) any decision concerning an opposition and any amendment made in an application for a patent;

(7) any grant of the patent right;

(8) any cessation of the patent right;

(9) any invalidation of the patent right;

(10) any assignment of the patent right;

(11) any grant of compulsory license for exploitation of the patent;

(12) any renewal of the term of the patent;

(13) any withdrawal, any being deemed to have been withdrawn and any abandonment, of an application for a patent;

(14) any change in the name or address of the patentee;

(15) any notification to the applicant whose address is not known;

(16) any other related matters.

The description, its drawings and the claims of an application for a patent for invention or utility model, and drawings or photographs of an application for a patent for design shall be published in pamphlet form.

Chapter IX

Fees

Rule 82. The fees which shall be paid when an application for a patent is filed with the Patent Office, or when other procedures go through the Patent Office, are as follows:

- (1) application fee and application maintenance fee;
- (2) examination fee, reexamination fee and opposition fee;
- (3) annual fee;
- (4) handling fee for transacting other patent matters: renewal fee for the patent for utility model or design, fee for a change in the bibliographic data, patent certificate fee, fee for the proof of priority, fee for a request for invalidation, fee for a request for a compulsory license, and a fee for a request for adjudication on exploitation fee of a compulsory license.

The amount of fees listed above shall be prescribed by the patent office separately.

Rule 83. Fees provided for in the Patent Law and in these Implementing Regulations may be paid to the Patent Office by way of bank or postal remittance. They may also be paid directly to the Patent Office.

Where fees are paid by way of bank or postal remittance, the applicant or the patentee shall indicate on the money order the kind of fees, the title of the invention-creation, the filing number or the patent number. In case where no such filing number or patent number has been accorded yet to the invention-creation, the applicant or the patentee or other interested parties shall indicate the date on which it or he filed the application.

Where fees are paid by way of bank or postal remittance, the date on which the transfer of such fees are ordered shall be the date of payment.

Rule 84. Where the application fee is not paid at the time of filing, or if the fee paid is insufficient, the Patent Office shall notify the applicant to pay the fee or to make up the deficiency within one month from the date of filing the application. If the fee is not paid or the deficiency is not made up within the time limit, the applications shall be deemed to have been withdrawn.

Rule 85. Where the prescribed fees are not paid when the applicant requests examination as to substance, or reexamination, or any person files an opposition or requests an invalidation of a patent right, it or he may pay the fees within 15 days from the date on which the request is made or the opposition is filed, but the date of payment may not exceed the time limit the Patent Law prescribes for the request for examination as to substance or reexamination or for the opposition to be filed. If the payment is not made within the time limit, the request is deemed to have not been made or the opposition is deemed to have not been filed.

Rule 86. Where the applicant for a patent for invention has not been granted a patent right within two years from the date of filing, it or he shall pay a fee for the maintenance of the application from the third year. The first maintenance fee shall be paid within the first month of the third year. The

subsequent maintenance fees shall be paid in advance within the month before the expiration of the preceding year.

Rule 87. The first annual fee shall be paid when the patent certificate is issued. Where the maintenance fee of the application for the year has already been paid at the time of the grant of a patent right, the patentee shall make up the difference on the basis of the amount of the annual fee of the same year. The subsequent annual fees shall be paid in advance within the month before the expiration of the preceding year.

Rule 88. Where the maintenance fee of the application or the annual fee is not paid in due time by the applicant or the patentee, or the maintenance fee or the annual fee paid is insufficient, the Patent Office shall notify the applicant or the patentee to pay the fee or to make up the deficiency within six months from the expiration of the time limit within which the maintenance fee or the annual fee was to be paid. The applicant or the patentee shall at the same time pay a surcharge which amounts to 25 percent that of the maintenance fee or the annual fee. Where the fees are not paid within the six months the application shall be deemed to have been withdrawn or the patent right shall be deemed lapsed from the expiration of the time limit within which the maintenance fee or the annual fee was to be paid.

Rule 89. Where in accordance with the provisions of Article 45, paragraph 2, of the Patent Law, the patentee requests the renewal of the term of the patent for utility model or design, it or he shall make the request within six months before the term expires, and at the same time pay the renewal fee. In cases where, at the expiration of the said period, the patentee fails to pay the renewal fee, the request shall be deemed to have not been made.

Rule 90. Any individual who files an application for a patent or has other matters to attend to, and who has difficulties in paying the various fees prescribed by Rule 82 of these Implementing Regulations, may submit a request according to prescriptions to the Patent Office, asking for a reduction or postponement of payment.

The conditions for the reduction or postponement of the payment shall be prescribed by the Patent Office.

Chapter X

Supplementary Provisions

Rule 91. Anyone may, after approval by the Patent Office, inspect or copy the files of the published or announced applications for patent, the Patent Register and any relevant supporting documents.

Rule 92. Any communication with the Patent Office shall be made in the prescribed form of the Patent Office. It shall be signed or sealed by the applicant or its or his patent agent.

Rule 93. Where documents or objects relating to an application for patent or patent right are submitted to the Patent Office, the number of the application or the patent and the title of the invention-creation shall be indicated. Where documents or objects are sent to the Patent Office by post, they must be registered.

Rule 94. Any sheets constituting the application for patent shall be typed or printed. All the characters shall be neat and clear, and they shall be free from any alterations. Only the right side of the paper shall be used.

Drawings shall be made in black ink with the aid of drafting instrument. All lines in the drawings shall be uniformly thick and clear.

Rule 95. The Patent Office shall be responsible for interpreting these Implementing Regulations.

Rule 96. These Implementing Regulations shall enter into force on 1 April 1985.

(Translated by the Patent Office of the People's Republic of China. In case of discrepancy, the original version in Chinese shall prevail.)

Proclamation (No 4) of the Patent Office of the People's Republic of China
(January 19, 1985)

Under Article 67 of the Patent Law of the People's Republic of China, any application for a patent filed with, and any other proceedings before, the Patent Office shall be subject to the payment for a fee as prescribed. The various items of patent fees to be paid are prescribed in the first paragraph of Rule 82 of the Implementing Regulations of the Patent Law of the People's Republic of China. According to the second paragraph of the same rule, a list of the patent fees to be charged is hereby issued as follows:

Patent Fees

(Unit: RMB [renminbi] yuan)

1. Application fee for	
(1) patent for invention	150
(2) patent for utility model	100
(3) patent for design	80
2. Application maintenance fee for patent for invention, per year	100
3. Examination fee for applicaton for patent for invention	400
4. Reexamination fee for	
(1) application for patent for invention	200

(2) application for patent for utility model	100
(3) application for patent for design	80
5. Opposition fee for	
(1) application for patent for invention	30
(2) application for patent for utility model	20
(3) application for patent for design	20
6. Renewal fee for the term of patent for utility model or design	100
7. Handling fee for making changes in the bibliographic data	10
8. Patent certificate fee for	
(1) patent for invention	100
(2) patent for utility model	50
(3) patent for design	50
9. Fee for the proof of priority	20
10. Fee for a request for invalidation of	
(1) patent for invention	300
(2) patent for utility model	200
(3) patent for design	150
11. Fee for a request for a compulsory license for exploitation of	
(1) patent for invention	300
(2) patent for utility model	200
12. Fee for a request for adjudication on exploitation fee of a compulsory license	100
13. Annual fee for	
(1) patent for invention from the 1st year to the 3rd year, per year	200
from the 4th year to the 6th year, per year	300
from the 7th year to the 9th year, per year	600
from the 10th year to the 12th year, per year	1200

from the 13th year to the 15th year, per year	2400
(2) patent for utility model from the 1st year to the 3d year, per year	100
from the 4th year to the 5th year, per year	200
from the 6th year to the 8th year, per year	300
(3) patent for design from the 1st year to the 3d year, per year	50
from the 4th year to the 5th year, per year	100
from the 6th year to the 8th year, per year	200

Notes:

1. Where the applicant or the patentee is a foreigner, any of the above-listed fees shall be paid in foreign currency according to the exchange rate at the time of payment.
2. The ordinal number of years listed in Item 13 shall be counted from the filing date. The annual fee shall, beginning with the year in which the patent right was granted, be paid according to the amount prescribed for that year.

CSO: 4010/83

NATIONAL DEVELOPMENTS

BRIEFS

JIANGXI PERSONNEL TRANSFERS--The Jiangxi Provincial Department of Labor and Personnel in 1984 made 1,813 job transfers and readjustments of specialized technical cadre. The technical personnel have been reassigned to departments and key projects relevant to their occupational specialties. As a result of the transfers and readjustments, 583 persons have been reunited with their spouses after long separation due to different work posts. [Nancheng Jiangxi Provincial Service in Mandarin 1100 GMT 25 Jan 85 OW]

QINGHAI ESTABLISHES SCIENTIFIC NETWORK--The province has made great progress and remarkable results in scientific and technological work since last year. Presently, the province has 37 prefectures, cities, counties and districts that have restored or established scientific organizations; and 117 towns and townships that set up associations for popularizing science. Before the cultural revolution, the province only had 23 scientific institutes at the provincial level. But there are 60 associations, societies and research institutes that have a rather complete range of courses, with a total membership of over 13,000. Also, there are 242 associations, societies and research institutes in various autonomous prefectures, prefectures, cities and counties. [Xining Qinghai Provincial Service in Mandarin 1100 GMT 23 Jan 85 HK]

SHANXI CHEMICAL INDUSTRY DISCUSSION--In order to speed up the building of the province's energy and heavy and chemical industry bases, and a recent provincial conference of chemical industry bureau chiefs stressed that chemical industry enterprises must make two shifts: 1. The chemical industry departments at all levels must shift from taking charge of the production operations of the enterprises to concentrating on providing all-round guidance for the sector, do a good job in coordination and supervision, and create conditions for clearing away obstacles for the enterprises. 2. The chemical industry enterprises must shift from purely production operations to developmental production operations. They must also develop horizontal ties between the enterprises and act to strengthen competitiveness. They must strive to fulfill by 1988, which is 2 years ahead of schedule, the doubling of total output value of the province's chemical industry and make still greater contributions to building the province's energy and heavy and chemical industry bases. [Text] [Taiyuan Shanxi Provincial Service in Mandarin 2300 GMT 13 Feb 85 HK]

LEADERS CONGRATULATE SHANGHAI SCIENTISTS--Shanghai, 9 Feb (XINHUA)--Over 200 people met here today to congratulate 20 scientists on 50 years' research. They are Shanghai researchers and associate researchers of the Chinese Academy of Sciences. The oldest is 87 and the youngest 72. Eight are divisional academicians, including organic chemist Wang You, a pioneer of Chinese antibiotics research, biochemist Wang Yinglai and physiologist Feng Depei. By message and letter, state councilors Zhang Jingfu and Fang Yi thanked the scientists for their contributions to China's scientific research. Academy President Lu Jiaxi also sent a congratulatory letter. Feng Depei, 77, said he would continue work for the country's economic development. Wang Yinglai, a 1941 Cambridge Phd, said he would try his best to train young scientists in his remaining years. The Chinese Academy of Sciences issued certificates of honor to the scientists and its Shanghai branch gave each a jade horse.
[Text] [Beijing XINHUA in English 1624 GMT 9 Feb 85 OW]

CSO: 4010/85

APPLIED SCIENCES

EARTHQUAKE SCIENTIFIC RESEARCH FUND ESTABLISHED

OW161426 Beijing XINHUA in English 1154 GMT 16 Jan 85

[Text] Beijing, 16 Jan (XINHUA)--The State Seismological Bureau of China has set aside 4 million yuan as an earthquake research fund this year.

Gao Wenzhe, deputy director of the bureau, said today that the fund would go to scientists for basic research in earthquake prediction and earthquake engineering.

The fund will principally support research projects of new ideas and major scientific value, he said at a bureau planning meeting. It will first be awarded to individuals or research groups under the bureau.

Priority will be given to projects undertaken by younger scientists and those in remote areas, he added.

So far the bureau has more than 2,000 scientists engaged in earthquake prediction and engineering.

In recent years, the bureau has combined earthquake monitoring with earthquake prediction and scientific research, with the focus on monitoring in the key quake-threatened zones.

The bureau last year reconstructed 40 seismic stations and built six seismic telemetric seismological networks in the cities of Beijing, Shanghai, Shenyang, Kunming, Lanzhou and Chengdu. The construction of a national data center for earthquake forecasting and analysis is being pushed ahead in Beijing.

Ten quakes registering over 5 on the Richter scale, including a 6.2-magnitude quake in the southern Yellow Sea on 2 May were recorded last year.

This indicated less seismic activity in China, Gao said.

CSO: 4010/75

APPLIED SCIENCES

BUREAU REVIEWS MARINE SURVEY ACHIEVEMENTS

OW071724 Beijing XINHUA in English 1557 GMT 7 Feb 85

[Text] Beijing, 7 February (XINHUA)--China's achievements in marine surveys last year were outlined today by a spokesman for the State Oceanography Bureau.

He said the bureau's 1984 surveys took 208 voyages, 2,040 days and 134,625 nautical miles. Nine survey ships sailed over 100 days each and three, more than 10,000 nautical miles each.

Major achievements included:

--the first survey of the Kuroshio (Japan current), giving hydrological, meteorological, biological, chemical and physical data. An anchored buoy to measure flow rate was recovered, providing 21 day's data despite a typhoon;

--surveys of some 6,000 kilometers of coastal waters, data on 5,000 kilometers of which are being processed. Another 7,000 kilometers are being surveyed;

--an on-going survey of the Southern Ocean and Antarctic: the "Xiangyanghong 10" survey ship and "J121" salvage and rescue ship left Shanghai on 20 November and reached King George Island on 26 December, where the 500-member expedition began setting up its "Great Wall" observation station.

--surveys of the Central South China Sea: in three voyages lasting 66 days and covering 10,000 nautical miles, scientists collected some 10,000 data on marine environment.

At a conference now in session here, State Oceanography Bureau Director Luo Yuru stressed the need to safeguard China's marine rights and interests, speed up surveys of marine resources and prevent marine pollution.

He called for surveys to provide data for offshore oil exploration and development, harbor construction and seafood breeding.

CSO: 4010/81

APPLIED SCIENCES

ANTARCTIC EXPEDITION GATHERS WEATHER DATA

0W061021 Beijing XINHUA in English 0845 GMT 6 Feb 85

["First Chinese Meteorological Observation in Antarctic Obtains Results (by Zhu Youdi)"--XINHUA headline]

[Text] King George Island, 5 Feb (XINHUA)--The first meteorological observation and forecasts carried out by the Chinese expedition team in the Antarctic during the past month have yielded data and some elementary knowledge about the patterns of the climatic changes in summer here.

Under the complex and changeable Antarctic climate, clear and cloudy weather, rain and snow come alternately within a day. The wind can be as strong as force 10 and above with frequent polar storms. The meteorologists of the expedition have gradually improved the accuracy of their forecasts and laid a foundation for China's scientific activities here in the future.

The Beilngsgäusen Sea is one of the areas where Antarctic cyclones occur most frequently. The meteorological observation recorded more than 20 days with winds of force 6 and above and one cyclone in every two to three days last month.

Braving the howling winds, the meteorologists mounted the shaking deck of the scientific ship "Xiangyanghong 10" time and again to do their observation. They analyzed a storm with a force 12 wind on January 26 and made their timely contribution to leading the ship out of a polar cyclone.

CSO: 4010/87

APPLIED SCIENCES

ANTARCTIC EXPEDITION GATHERS DEEP OCEAN SAMPLES

OW100821 Beijing XINHUA in English 0737 GMT 10 Feb 85

["Chinese Expedition Gathers Deep Ocean Samples in the Antarctic Ocean (By Zhu Youdi)"--XINHUA headline]

[Text] S.S. Siangyanghong 10, Antarctic Ocean, 9 Feb (XINHUA)--The Chinese Antarctic expedition team today successfully gathered some geologic samples and deposits of deep ocean ooze from the seabed of the Antarctic Ocean more than 4,100 meters below sea level.

The team also conducted a complex of 10 surveys on four subjects.

The S.S.Xiangyanghong 10 reached its destination the No 11 ocean observation station late last night. The state is in the South Pacific Ocean, and the water there is the deepest among their [as received] more than 30 ocean observations station in the Antarctic Ocean.

The deep ocean ooze gathered was appraised by experts as the deposits of the quaternary period. There are some sand in the one-centimeter surface of the ooze and the experts said the sand had been carried here from the Antarctic continent as a result of the movement of glaciers.

The temperature of the water over 4,000 meters under the surface is 2 degrees Celsius while that of the deep-ocean ooze is 1 degree Celsius.

The Chinese scientists will further analyze the deposits.

CSO: 4010/87

APPLIED SCIENCES

ANTARCTIC EXPEDITION MEMBERS LAND ON CONTINENT

OW090756 Beijing XINHUA in English 0743 GMT 9 Feb 85

[By Zhu Youdi]

[Text] Antarctic Peninsula, 8 Feb (XINHUA)--Thirty-six Chinese Antarctic expedition members set foot on the Antarctic Peninsula at 2:30 p.m. yesterday for scientific activities.

It was the first time in the Chinese scientific history that so many expedition members landed on the Antarctic continent simultaneously.

An Antarctic cyclone was closing in when the ship "Xiangyanghong 10" they boarded left the sea area northwest of south Shetland Islands and sailed southward early yesterday morning. The ship turned south immediately and took shelter in the Croker Strait between the peninsula and Brabant and Anvers Islands.

Ranges of high glaciers rise steeply on the west coast of the Antarctic peninsula and magnificent icebergs of various shapes float in the sea. When the expedition ship entered the strait, people mounted the deck and feasted their eyes on the wonderful scenery of the Antarctic continent.

The "Xiangyanghong 10" anchored offshore about six nautical miles from the chosen landing spot at the foot of a huge glacier. Because the small boats carrying the expedition members ashore were not able to make land, the expedition members waded across to the shore. They hoisted the five-starred red flag on the beach.

Chen Dehong, general director of the Chinese team, told XINHUA on the scene that the successful landing showed the capability of the Chinese expedition to carry out scientific research there. And they will be able to do research in other areas of the Antarctic continent as well in the future, he added.

After the landing, the scientists did geological and biological surveys there.

CSO: 4010/87

APPLIED SCIENCES

SURVEY AND FORECAST OF SUPERCOMPUTERS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 11, No 3, May 1983 pp 91-98

[Article by Ci Yungui [1964 0061 2710] and Hu Shouren [5170 1343 0088] of Changsha Institute of Technology: "A Survey of Supercomputer Architectures"]

[Text] Abstract: In recent years, in order to handle massive volumes of data and very big problems, there has been a growing demand among many trades and professions for supercomputers with greater throughput and computing power. A brief introduction on the performance, characteristics and applications of several typical types of supercomputer systems is presented in this paper with special emphasis on future trends in light of various improvements achieved in hardware, software and system architecture. A forecast is given on the growth of supercomputers in the 1980's.

I. Introduction

Super scale computers (hereafter referred to as supercomputers for short) are regarded as the largest and most powerful electronic computers with the best performance. They are employed specially for solving giant problems in scientific computation, engineering designing or data processing which can not be handled by ordinary large scale mainframes. For example, aircraft and spacecraft designing involve air dynamic problems that are extremely complex to calculate; thus, secondary factors used to be neglected in approximate calculations, and actual data used to be obtained from wind tunnel tests. For instance, while the DC-3 aircraft only requires 300 hours of tunnel tests, the space shuttle needs 50,000 hours of tunnel testing not to mention the entailment of cost and development period that are becoming intolerably expensive. What is even more important is that the limitations of wind tunnels are becoming increasingly salient as flight altitude and speed increase, plus the fact that wind tunnel tests are somewhat affected by such factors as air current pressure, density, velocity and temperature, air current uniformity, tunnel wall disturbances and aeroelastic deformation. Thanks to "air dynamics computation" by advanced computers, it is not only possible to solve air dynamic differential equation sets with fairly good

precision and thus greatly reduce the need for wind tunnel tests, it is also possible to simulate air current fields that are even more realistic than wind tunnels, thus helping to improve the quality of designing work, shorten designing time, and reduce development cost. The prominent role which U.S.-made supercomputers play in the development of space technology today is ample proof of its significance.

As another example, the designing of nuclear weapons or reactors involve partial differential equations. Due to the complexity of the problems, the requirements on computer performance are extremely stringent. In the past, owing to the limitations of computer performance, approximations, simplified one-dimensional models, and rough grids were used in the simulation of physical processes, which affected the degree of precision. Moreover, the results of designing work had to be verified through actual tests. In order to improve the level of designing, it is necessary to employ mathematical models which can describe physical processes with greater precision and comprehension, such as two-dimensional or three-dimensional models. It is also necessary to use finer grids and time scales. All this plus great increases in the volume of data will bring about sharper demands on the storage capacity and speed of computers, which means greater demands for supercomputers.

Yet another example is the application of computers in medical diagnosis: based on the attenuation of x-ray waves emitted from an axial laminagraphic scanner and bounced back from various parts of a human body, a computer can compose multitudes of sectional diagrams of the body and generate rotating three dimensional images on the video screen, which allows the doctor to examine internal parts of the human body, and perform diagnosis of the patient. To produce three dimensional images with 1 mm resolution, the computer's speed must reach 2 billion instructions per second. This calls for supercomputers.

There are other applications which require the use of supercomputers, e.g., processing of satellite remote sensing pictures, petroleum exploration, computational chemistry, meteorological forecasting, etc.

Evidently, due to the inevitable demands resulting from the growth of modern science and technology, supercomputers have become a direction of development in the realm of computers.

II. Development of Foreign Supercomputers

In the mid-1960's, the United States began to develop supercomputer systems with speeds up to 10,000,000 instructions per second. In recent years, Japan and other developed industrial nations also went into this area of research and development. Tables 1 and 2 show the chief characteristics and uses of supercomputers which were developed in the 1970's and those that are currently being developed in the United States.

TYPE	R & D ORGANIZATION	R & D PERIOD	NO MANUFACTURED	OPER. SPEED (x10,000/sec)	MAIN MEMORY (x10,000 WORDS)	USER ORGANIZATION & APPLICATION	
						50-1,000	13
G E	ILLIAC-IV Univ. of Illinois & Burroughs Company	1966-1973	1	15,000		Ames Research Center	
N E	STAR-100 Control Data Corp.	1965-1974	4	5,000 (64 bit float pt add)		Lawrence Radiation Lab for nuclear weapons R&D; Langley Research Center for aircraft & spacecraft designing, and environmental simulation.	
L A				10,000 (32 bit float pt add)			
U S							
E	TI-ASC Texas Instruments	1966-1974	7	5,000	13-100	GSI Austin Company	
M A							
C C	CRAY-1 Cray Research Corp.	1972-1976	Approx 35	8,000 (float point result)	25-400	Los Almos Lab for nuclear weapons R&D; National Meteorological Center, European Mid-Range Meteorological Forecasting Center	
N E							
S S	BSP Burroughs	1978	1	5,000 (float point result)			
S P	STARAN Goodyear Aerospace Corporation	1972	4	30,000 (32 bit float pt result)		Rome Aeronautics Development Center for air traffic control; US Army Topographic Laboratory for automatic plotting, image processing, 3-D photometry, signal detection; NASA Johnson Space Center	
C A							
L U							
U S							
E P	PEPE System Development Corp. Burroughs Corp.	1971-1976	1			Ballistic Missile Defense Advanced Technology Center	
T Y							
P E							
S S							

TABLE 1 Summary table of supercomputers produced in the U.S. in the 1970's

TYPE	R & D ORGANIZATION	R & D PERIOD	NO MANUFACTURED	SPEED (X10,000 float pt/sec)	MAIN MEMORY (x10,000 WORDS)	USER ORGANIZATION & APPLICATION
CRAY-1S	Cray Research Corp	-1978	35	8,000	50-400	
CYBER-203	Control Data Corp	1975-1979	4	5,000 (64 bits)	50-200	NASA, Kirtland Air Force Base, Fleet Oceanology Center
CYBER-205	Control Data Corp	-1981	2	40,000 (64 bits) 80,000 (32 bits)	up to 400	Especially suitable for nuclear weapons R. & D., safety operations of nuclear power stations, aircraft & space shuttle designing, meteorological forecasting, oil exploration

TABLE 2 Summary table of supercomputer systems currently manufactured in the United States

Among the supercomputers currently being produced, the CRAY-1S series was developed on the basis of the CRAY-1 machine. All functional units employ pipeline technology which enables parallel processing. Moreover, the units are characterized by vector chaining capability and high speed, as well as the capability to perform short vector or scalar computations at high speeds. Based on various storage and I/O subsystem size requirements, the units can be configured into optimum systems tailored for specific needs. Currently, there are altogether 12 different models. CYBER-203 and 205 systems are new models developed by American-owned Data Control Corporation following the introduction of STAR-100. Compared with STAR-100, the former is characterized by higher degree of integration; the use of transistorized memory components in place of magnetic cores helps to increase instruction buffer storage, and new scalar processing units are installed. Even more powerful than CYBER-203, the CYBER-205 system is composed of a vector processor and a scalar processor, as well as a 64-word instruction buffer and a 256-word file register. Its vector processor performs array or data stream arithmetic operations through 1-4 pipelines. Virtual address is 2×10^{12} words.

The basic CYBER-205 system has 8-16 I/O units; each unit's transmission rate is 200 megabits per second, and the memory's bandwidth allows all 16 I/O units to work concurrently at maximum transmission rate, and enables extremely high speed vector processing.

Table 3 shows supercomputers currently developed and manufactured in foreign countries ^{4,5}, and following are brief descriptions.

1. CARY X-MP System

Composed of two CPUs and one multiport memory, which enables the user to run multiprocessor jobs or independent monoprocessor jobs concurrently. Its bipolar main memory enjoys a total capacity of 2 or 4 megabytes; its throughput rate is five times that of CRAY-1S/1000, and its memory band is eight times that of CRAY-1. The system's improved scalar processing is attributed to its shortened clock cycle and memory accessing cycle. Improved vector processing is attributed to multiport parallel accessing and hardware automatic chaining.

The high-performance channels of the system's I/O unit are linked to the mainframe, I/O subsystem and solid-state mass memory storage. Four 6 megabytes/second channels are employed to communicate with the mainframe; one 100 megabyte/second channel and one 6 megabyte/second channel are tied to the I/O subsystem. Besides, there is also a 1,250 megabyte/second solid-state mass storage channel which can theoretically transmit 8 megabytes of information within 8 milliseconds to the mainframe.

TYPE	R & D ORGANIZATION	R & D PERIOD	OPER. SPEED (oper per sec)	MAIN MEMORY (x10,000 WORDS)	USER ORGANIZATION & APPLICATION
CRAY X-MP System	Cray Research Corp (United States)	-1983		200-400	
CRAY-2S System	Cray Research Corp (United States)	-1985	Approximately 1,000,000,000 (float point)	400-3,200	
S-1 Multiprocessors System	Stanford University, University of California, Lawrence Livermore Lab (United States)	1976-1984	Approximately 1,000,000,000 (float point)		United States Navy
HEP System	Denelcor, Inc (United States)	-1981	10M-160M instructions per second		United States Military Ballistic Laboratory
NASF aerodynamics facsimile system	Burroughs Corp Data Control Corp (United States)	1977-1986	more than 1,000,000,000 oper per sec (float point)	over 3,000	
MPP mammoth parallel processor	Goodyear Aerospace Research Corp (United States)	-1982	6,000,000,000 oper per sec (8 bit integer addition)		satellite image processing
FACOM VP-200 VP-100	Fujitsu (Japan)	-1983	160,000,000 oper per sec (32 bit float point add)	800-3,200	
S810/20 S810/10	Hitachi (Japan)	-1983	500,000,000 oper per sec float point 250,000,000 oper per sec float point	630,000,000 oper per sec float point 315,000,000 oper per sec float point	

TABLE 3 Summary table of supercomputer systems currently being developed and manufactured in foreign countries

2. FACOM VP-200 and VP-100 Systems¹¹

These high performance supercomputer systems were developed on the basis of experiences gained from FACOM 230-75 APU production lines and FACOM 380/383 general-purpose computer technology. Chief strongpoints are:

- (1) Use of superhigh speed technology - Logic circuit switching speed is 0.35 ns, clock cycle is 15 ns. Main memory employs superhigh speed LSI, each chip consists of 64 kilobit static MOS, average access time is 55 ns. To shorten circuitry lines, the newly developed MCC nad 3 dimensional pile-up structure is used, thus enabling the production of highly-compact large-scale systems.
- (2) Use of new type of hardware structure - The system has hardware structure with six pipeline vector units and high-speed scalar processing units; it has high-speed buffer memory with 5.5 ns access time as well as high-level advanced control equipped with scalar/vector instructions. It has outstanding parallel processing capability. Besides, it has 82 vector commands, and uses such new techniques as conditional vector processing and all kinds of vector data structure processing.
- (3) Use of super performance software - For example, utility control efficiency is improved by using matured uatomated operating techniques of the FACOM M series. Through the use of FORTRAN 77/VP compiler which has highly vectorized functions, FORTRAN source programs are directly compiled into object programs which can effectively utilize vector instructions. High speed processing is also made possible through procedures with conditional control statements.

3. HEP Computer System

Recently developed and manufactured by American-owned Denelcon company, this is a multiple instruction and multiple data stream computer system which can share resources. MIMD architecture is employed. Multiple processors share the same storage through multilayer multinodal network, and can concurrently execute multiple parallel programs. Each processor is capable of handling 128 processes; multiprocess supervision is automatically performed by hardware; processing speed can reach as high as 10M-160M instructions per second. The entire system is modular structured, can be scaled according to user needs, and is easily expandable. In the event of partial modular breakdown and servicing, the other functioning modules of the system can be reorganized into a low grade system through programming, thus ensuring the reliability and availability of the system. Owing to its fairly new architecture and designing concepts, this system has attracted wide attention in the computer world. It is the hybrid of instruction stream and data stream systems.

Although the software and hardware structures of all types of supercomputers developed since the 1970's have their own particular features, broadly speaking, the following measures are commonly adopted towards the main goal of enhancing computing power:

1. Modification of data structure and algorithm. General-purpose machines use scalar data structures and serial algorithms; besides scalar structures, supercomputers also have vector structures, and use parallel algorithms to enhance parallel computation.
2. Employment of large scale or superlarge scale superhigh speed integrated circuits and high density packing technique to shorten circuitry routes, and reduce mainframe clock period.
3. Employment of newly developed structural organizations:
 - (1) Pipeline technology. Execution of an instruction divided among several units, thus enabling overlapped execution of multiple instructions by different units, and therefore increasing throughput.
 - (2) Multiple function units. The computer has multiple special arithmetic and logical function units. The instructions of different operations can be concurrently performed by the function units, thus enhancing parallelism.
 - (3) Array structure. The mainframe is composed of multiple processing units which have identical structures, and can concurrently perform the same operation under the unified supervision of a common control unit.
 - (4) Multiprocessor system. Each processor has its own instruction stream and data stream. They can execute their own independent programs, or collaborate on a major processing task, thus enhancing system computing power.
 - (5) Other types, such as vector register, vector chaining technique, large instruction buffer, super cache buffer memory, multimodular large capacity memory cross accessing, and prime number modular memory structure, etc.
4. Software systems which support parallel processing. Based on hardware structure characteristics, configure systems with batch processing operating systems and highly efficient parallel processing systems which have highly efficient supervisory system resources and can run user programs. FORTRAN, Pascal and Ada compilers equipped with vector recognition capability can automatically detect vector components in source programs, thus fully utilizing vector processing capability.

COMPANY	Degree of Integration (gates/chip)	Stage Delay Time (ns)	Power Consumption (W)	Circuit Type	USES
Fujitsu (Japan)	100	0.6	3	ECL	M190, M200, Amdahl 470V
	400			ECL	Amdahl 580
	400/1300	0.35	3	ECL	M380, M382, VP-200, VP-100
		0.7	2	CML	ACOS 800/900
NEC (Japan)	200			CML	ACOS 1000
	200-1200	0.5-0.9	1.2-2		HITAC M280H
Hitachi (Japan)	550	0.35	3		CYBER-203, CYBER-205
	1500	0.45-0.8	3.5	ECL	IBM 4300
CDC (U.S.)	168	0.8			IBM 3081 chips
IBM (U.S.)	704	1.0	1.5	TTL	

TABLE 4. Comparison of chief characteristics of logical circuits used by various computers

III. Prospects

In order to further enhance the capability and efficiency of supercomputers, and produce machines capable of generating more realistic descriptions of complex mathematical models in giant systems, performing even more precise scientific computations and engineering designs in less time, the providing optimum engineering designs or economic construction plans based on optimized economic benefits and social effects, etc, it is necessary to adopt effective measures in system architecture, hardware, software and algorithm.

Hardware improvement depends on the selection of components, technology and structure. Today, electronics industries all over the world are putting enormous amounts of effort into such technical areas as developing microelectronics processing techniques, enhancing unit circuit speed and improving the integration of LSI and VLSI, developing microelectronics packing techniques, reducing circuitry routes and solving heat problem, meeting the needs for shorter machine clock period and high density packing, etc. Table 4 compared the chief characteristics of high speed integrated circuits used in some typical computer models. The IBM 3081 mainframe uses microelectronics packing techniques, i.e., its thermal condition modules are composed of substrates, chips, column stoppers, springs, metallic covers, and cooling plates. 100 (or 118) LSI circuits with 704 gates are installed on 33-layer $9 \times 9 \text{ cm}^2$ procelain substrates in accordance with specific logical requirements, and special cooling techniques are employed to solve heat problem. This type of module has approximately 45,000 gate circuits. Recently, new achievements were attained in improving the integration level of chips, i.e., as many as 5,000 gates can be found on a single chip.

However, it is not sufficient to merely rely on the improvement of components to enhance the speed and capability of computers. It is also necessary to focus on system structures, or even make breakthroughs in computer architectures, and the basic idea is to improve computer parallelism. Following are some predictions based on current trends in the development of extra-large machines and supercomputers.

1. Continued growth of super performance monoprocessor systems

Over the past 10-odd years, in order to enhance the computing capacity of computers, many measures have been taken in changing system structures, e.g., wide use of memory cross accessing and superhigh speed buffers, multiple general-purpose registers, multiple function units, advanced control technique, pipeline and array structure, and other techniques are all effective measures. The introduction of vector operations, in particular, has helped to maximize the use of the preceding techniques. ILLIAC-IV, CDC STAR-100, TI-ASC, CRAY-1 and other general-purpose supercomputers currently being developed and manufactured in foreign countries are all examples of vector computers which have greatly improved the speed of vector processing through logarithmic set operation. The CRAY-1 machine, in particular, was the first computer to employ vector registers,

which helped to reduce setup time of vector operations, avoided STAR-100's deficiency in short vector processing, and made automatic chaining possible in vector processing, thus further improving parallel vector processing.

The enhancement of monoprocessor performance still constitutes the mainstream of current supercomputer growth, and the reasons are:

- (1) The great wealth of software resources currently available to us are the result of many years of accumulation from the continuous improvement and growth of monoprocessors in the extensive application of computers. Such software resources are comparatively matured and reliable, and naturally should be inherited and developed (but they could also become obstacles to the growth of new computer architectures).
- (2) While multiprocessor systems are regarded as the direction of development, they are also developed on the basis of monoprocessor systems. Naturally, to develop highly efficient multiprocessor systems, it is also necessary to produce highly efficient monoprocessors.
- (3) Looking into the current trend of growth of integration technology, the integration level and work speed of silicon components are continuously being improved, power consumption is continuously being reduced, microelectronics packing technique is in the process of development, major results have been achieved in developing faster switching speed in Josephson-function logic circuit, there are immense potentialities in the development of monoprocessor systems, and further improvements will be made in memory capacity, operation speed, and channel transmission rate, etc. It is predicted that by the end of the 1980's, super-large monoprocessors will be able to execute as many as 30 million instructions per second.

Supercomputers will further combine the use of multiple registers, multiple function units, pipelines and array structures, and make maximum use of vector operation characteristics. But vector processing machines of the past, such as STAR-100, perform scalar operations much slower than high-speed scalar processing machines, although their speed can exceed high-speed scalar computers by a considerable margin. However, all practical problems require a certain proportion of scalar processing, which means that the magnitude of scalar processing speed can greatly affect the overall performance of a vector computer system. This was precisely why the CRAY-1 was very well received by the computer market. As a result, CDC was forced to stop the STAR-100 production line after producing the fourth machine, and the TI-ASC production line met similar fate after the seventh machine. CRAY-1 became the most marketable supercomputer. It is quite evident that while developing vector processors is an evitable trend, it is also important to vigorously improve the scalar processing speed of vector machines.

2. Parallel Processors System (Array Processors System)

With the development of large scale and super large scale integration technology, and especially with the rapid growth of single-chip microprocessors, the improvement of computing power through the use of parallel processors systems has become an important aspect in the development of supercomputers. Systems which fall in this category include: ILLIAC-IV which was jointly developed by University of Illinois and Burroughs Corporation, STARAN which was developed by Goodyear Aerospace Corporation, and PEPE which was developed by Burroughs Corporation. Satellite picture processing requires computers which can execute 10 million to 10 billion instructions per second. Goodyear Aerospace Corporation's large-scale parallel processor MPP is composed of 16,384 processors grouped into an 128x128 array, and employed as an array system for high speed processing of satellite pictures. Britain's ICL company developed a distributed array processors system known as DAP which has 4,096 microprocessors and a large-scale series machine 2900. It's maximum computing speed is 100 million floating-point instructions per second on 64-bit data. These computer systems are all suitable for vector operations, i.e., all microprocessors (or processing units) can execute the same instruction in each clock period. Supercomputer ILLIAC-IV has played a historical role in the development of vector computation and parallel processing. But remarkable performance gaps occur when the systems are used for different processing problems. As general purpose machines, they are poor performers. For example, although DAP is equipped with very powerful vector processing capabilities, its performance in short vector or scalar operations is very poor. Besides, the 2900 machine is very slow. Thus, the DAP system is somewhat limited by its overall throughput rate; in other words, it is only suitable for special applications. To further illustrate, the STARAN system is employed by the United States Air Force for air traffic controlling, and PEPE system is used by the U.S. military for anti-ballistic missile defense. In sum, these systems are still being developed for special applications, especially for non-numeric computations.

3. Multiprocessor System

To improve throughput rate, multiple processors are employed to work concurrently in a multiprocessor architecture. The processors can be used either for processing a common problem, or for processing their own individual assignments. This type of architecture falls somewhere between a tightly coupled parallel processors system and a loosely coupled multicomputer system. Multiprocessor system has a fairly high performance cost ratio. Thus, multiprocessor architecture is an inevitable trend in the development of supercomputers. For instance, there are plans to build CRAY-2, S-1 and HEP systems with 4-16 cupseperformance unit processors which are networked to share common main storage systems made up of multiple modular storage components. But the manufacturers all intend to start from 2-processors systems or 4-processors systems, e.g., the CRAYX-MP machine is a dual processor system developed and

manufactured by the Cray Research Corporation, and the CRAY-2 system is a four processors system. Most of the supercomputers currently available are dual processor systems, and the reasons are:

- (1) In the past, algorithms for scientific calculations were serial. To enable a multiprocessor system to run efficiently, every processor must run at any given point of time. This means that algorithms need to be developed to solve the parallelism problem, i.e., how to divide a problem into segments (or processes) for parallel processing by the processors, while allowing the processors to synchronize, coordinate and communicate with each other at the same time. Research on parallel algorithm and parallel processing began only in recent years.
- (2) It is difficult for traditional operating systems to supervise, control or schedule the entire multiprocessor system. The increasing number of processors not only causes controlling to become complex and scheduling more difficult to handle, it also causes system costs to go up dramatically and system efficiency to drop.
- (3) FORTRAN high level programming language is suitable for serial processing scalar computers. To allow multiprocessor systems to run currently available programs or enable users to continue programming in standard FORTRAN language, it is necessary to have a high level language compiler which can recognize parallelism, i.e., it can automatically break up a computational process into segments which can be put through parallel processing. The multiple processors are all controlled by a single operating system, and the processors can run their own programs concurrently. Besides automatically identifying parallelisms in source languages, this new type of high level language compiler should also be able to compile them into object programs, and thus enable the entire system to run every efficiently. This is quite an undertaking.
- (4) In a multiprocessor system, all processors share the same system resources, including hardware and software. This could lead to competition for the shared resources, and thus directly affect system efficiency.
- (5) Designing hardware networks is a crucial step; the more processors and storage modules there are, the more complex and gigantic the networks become.
- (6) The prices of multiprocessor systems rise linearly with the increasing number of processors. Due to communication costs and inevitable low utilization rates of individual processors, the improvement of overall performance is slowed down drastically. Thus, as processors increase in number, the performance cost ratio is bound to drop.

All of the above are vital issues which need to be resolved in order to develop multiprocessor systems. These problems are receiving more and more attention.

In a multiprocessor system where there are N number of processors working on a computation problem, the system is at the peak of its efficiency, and the overall performance is N times the performance of a single processor. If a job requires only one processor unit, the other processors remain idle throughout the job and the system is at its lowest efficiency, i.e., the overall performance of the system is merely equal to the performance of one processor. In actual scientific computation runs, there are always low efficiency and high efficiency situations; as N increases, the low efficiency problem becomes increasingly acute. Thus, from the standpoint of the entire system's efficiency (scientific and engineering numeric calculations only), the employment of a multiprocessor system composed of a small number of superhigh speed processors can be more advantageous than a multiprocessor system with a large number of low speed processors. This appears to be also true as far as a multiprocessor system's operating system, high-level language compiler and hardware networking are concerned. In sum, based on the development of integrated circuits, especially LSI and VLSI, multiprocessor systems will become an inevitable trend in the development of supercomputers. But in the immediate future, the best way to enhance the computing power of general purpose computer systems is to build multiprocessor systems composed of small numbers of superperformance processor units.

On the other hand, in the realm of non-numerical applications, such as artificial intelligence, image processing, picture analysis, etc., all types of multiprocessor systems composed of thousands or tens of thousands of microprocessors are being developed. Such systems can perform billions of instructions per second. The immensity and diversity of ideas involved is extremely fascinating.

4. Data Stream Computer Systems

None of the preceding types of pipeline structures, multifunction units, array structures or multiprocessor systems, etc. are free from the traditional Von Neumann's designing concept of stored program principle, i.e., loading a serial algorithmic program into the main memory in a certain order, and executing it in the sequence of the control instructions from the computer's program register. The above-described method of using control streams to drive the execution of programs essentially reflects the characteristic of serial algorithm, which limits the further growth of parallelism. Data stream computers have enabled parallel processing to completely break away from the bounds of Von Neumann's architecture. As there is no program register in this type of machine, any instruction can be immediately executed so as long as it has an operand. Thus, if a problem has parts which can be executed through parallel processing and are not mutually dependent in the processing of data, the program can be executed by the data stream driving method which allows for the maximum use of parallelism in a natural way. Hence, computer systems developed after this new type of system architecture can outmatch traditional structure machines by 1-2 speed magnitudes. Furthermore, data stream machines have relatively

simple structures with fewer types of units; they are produced in larger numbers, and are suitable for LSI or VLSI technologies. These features are precisely why a great deal of attention in the computer world is being focused on data stream computers, e.g., a great deal of research effort is being thrown into this field in the United States by Massachusetts Institute of Technology, Illinois University and Texas Instruments, in the United Kingdom by Manchester University, and in France by Toulouse Research & Development Center. Some of them have already developed prototype machines.

In as much as data stream computers and traditional machines are completely different from each other in terms of designing idea and architecture, it is only natural that high-level languages based on Von Neumann's structure are not suitable for this new type of structure. Thus, besides hardware research, it is imperative to first develop data stream computer programming languages. As the algorithms themselves are characterized by parallelism, data stream computer programming languages are convenient for compiler programming, program optimization, and can be naturally compiled into object codes suitable for parallel processing.

For more than three decades, Von Neumann's designing ideas and architecture have had a strong and deep-rooted impact on us; the ever-growing wealth of system software and application software accumulated through many years of use, in particular, can not be discarded lightly. Thus, in spite of their numerous outstanding characteristics, data stream computers will experience an uphill struggle before they are finally accepted as products. Perhaps the most prospective course to take is to first develop special-use machines.

IV. Conclusion

The social and economic factors leading to the inevitable development of supercomputers consist of the continuous and vigorous growth of modern science and technology, especially the ever-growing development of space and nuclear technologies, the research activities in life sciences, the exploitation of energy sources and other natural resources which are valuable to nations throughout the world, the vast amount of efforts thrown into the simulation of giant systems, analysis of resources, and formulation of national economic plans, etc. The material basis for the tremendous improvements in the performance of supercomputers lie in the development of microelectronics processing and packing techniques, and the growth of CAD, which, in turn, had contributed to the development of LSI, VLSI, microprocessors and microcomputers. There is reason to predict that towards the end of the 1980's, pipeline units composed of superhigh speed chips, or special LSI or VLSI components for other function units will emerge. The main memory capacity of supercomputers will increase to as much as thousands of megabytes through the materialization of megabits-size memory chips. Non-numerical application supercomputer systems and distributed-structured

systems composed of multitudes of micros will enjoy greater growth. Supercomputers will outrank the machines of the 1970's by a magnitude of two in terms of performance and computing capacity. Looking further ahead into the 1990's, while developing extremely integrated and extremely fast VHSIC (Very High Speed Integrated Circuit) components, new types of gallium arsenide or Josephson-function devices which have faster switching speeds and lower power consumption rates will become available for practical use, and fifth generation computers representative of new systems and new structures will appear. The processing capability of supercomputers, including memory capacity and computing speed will progressively increase in magnitudes, and thus bring about a new leap forward in the development of computing technology.

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6 March 1985

APPLIED SCIENCES

BRIEFS

NEW CHINESE CHARACTER PROCESSOR DEVELOPED--The (Jinshan) Computer Application Research Center's information department and the Shanghai Printing Technology Research Institute have, with the cooperation of departments concerned, developed a set of high quality nationally standardized Chinese character numerals for information exchanges. With clear and neat printout, it is the best Chinese character processor at home and abroad. Its application and popularization will accelerate the development of the Chinese character information processing technology, the application of computers, and office automation. [Text] [Beijing Domestic Service in Mandarin 1200 GMT 6 Feb 85 OW]

INTEGRATED CIRCUIT RESEARCH--Shanghai's Jiaotong University has successfully developed a system to analyze medium-large computers' integrated circuits. The system can enlarge the diagram and inner structure of an integrated circuit from a very small chip by nearly 1,000 times. It can also transform the diagram into data for processing. This has paved a new way for large-scale research and production of integrated circuits. The system has passed a test recently and will promote our country's electronic industry. [Summary] [Beijing Domestic Service in Mandarin 1200 GMT 12 Jan 85 OW]

NEW COMPUTER SOFTWARE--Guangzhou, 8 Jan (XINHUA)--Zhang Xieping, a computer technician at the logistics department of the Guangzhou Military Region, has successfully developed new computer software for use in processing personnel files, stock supplies, accounts, and library information. The software, called Data Base Control System DBZ 80, is an improved version of the DBASE II system developed in the United States. The new software corrects some 40 errors in the original system and doubles operation efficiency. [Summary] [Beijing XINHUA Domestic Service in Chinese 0811 GMT 8 Jan 85 OW]

DELEGATION TO VISIT ANTARCTIC BASE--Beijing, 9 Feb (XINHUA)--A Chinese delegation headed by the chairman of the national Antarctic research committee, Wu Heng, left here today for the Antarctica to attend the inauguration of "the great wall" observation station. Speaking to reporters at the airport, Wu said that the delegation would convey the greetings of the government to the Chinese Antarctic team and to thank those friendly countries for helping the team build the station. Deputy leader of the delegation Yang Kuoyu will leave for the Antarctica on February 11. The delegation was sent off at the airport by Yan Jici, vice-chairman of the standing committee of the National People's Congress and Luo Yuru, the director of the state oceanography bureau. [Text] [Beijing XINHUA in English 1309 GMT 9 Feb 85 OW]

POLISH STATION IN ANTARCTICA--King George Island, 9 Feb (XINHUA)--Chinese scientists today paid a visit to a Polish observation station in Antarctica and had cordial conversations with scientists from Poland, Brazil, Federal Germany and the United States there. The hosts of the station briefed the Chinese scientists on their research in the fields of biology, geomagnetism and meteorology. The Chinese scientists gave an introduction on the building of the "great wall" observation station and their future plan for scientific research in the Antarctica. All the scientists indicated that they will continue to promote exchanges and cooperation in their future research and to contribute to making use of the Antarctica for peaceful purposes. [Text] [Beijing XINHUA in English 1846 GMT 10 Feb 85 OW]

NUCLEAR FUSION RESEARCH CENTER COMPLETED--A center for controlled nuclear fusion and plasma physics research under the Chinese Academy of Sciences has been completed recently. The center, a key state scientific research construction project, is located in the Plasma Physics Research Institute of the Chinese Academy of Sciences by (Shushan) Lake in a northwestern suburb of Hefei. The No 8 project, a project for the construction of the center, was checked and accepted by the state on the afternoon of 20 January. A meeting on checking and accepting the No 8 project was held on the afternoon of 19 January. Present at the meeting were Zhou Guangzhao, vice president of the Chinese Academy of Sciences; Wang Yuzhao, deputy secretary of the Anhui Provincial CPC Committee and governor of Anhui Province; and responsible comrades of the state and provincial departments concerned. On behalf of the provincial party committee and the provincial government, Wang Yuzhao extended his cordial regards and warm greetings to the leading comrades, experts and scholars from various quarters who took part in checking and accepting the project, and to the engineering and technical personnel who participated in the project's designing, building and assembling. [Excerpts] [Hefei Anhui Provincial Service in Mandarin 1100 GMT 20 Jan 85 OW]

CSO: 4008/207

LIFE SCIENCES

PRC ATTENDS NEW DELHI PHARMACOLOGY CONGRESS

OW191943 Beijing XINHUA in English 1917 GMT 19 Jan 85

[Text] New Delhi, 19 January (XINHUA)--The first Asian congress of pharmacology, which concluded here today, called for close cooperation and exchanges of information and experts in pharmacology among Asian countries.

The 5-day congress was attended by about 700 delegates from Bangladesh, China, Egypt, India, Indonesia, Iran, Iraq, Pakistan, Saudi Arabia and other countries.

The congress paid special attention to the research of drugs against tropical diseases like malaria and leprosy.

The delegates agreed to conduct and promote a joint research program on these diseases to help Asian countries reduce their dependence on developed countries.

Inaugurating the congress, Indian President Zail Singh urged developing countries to step up their efforts for research in medicines for tropical diseases. Those produced by the developed countries did not suit the developing countries, he said.

He referred to China's development of a new anti-malaria drug from plant sources as proof that medical scientists in developing countries could come up with positive results if they took the initiative in the right direction.

Other issues discussed at the congress ranged from environmental pollution in developing countries to drug-abuses.

The experts also agreed to update the courses of studies in medical colleges in developing countries to keep abreast with the advances made in medical sciences.

The Second Asian Pharmacology Congress will be held in Baghdad in Iraq in 1989.

CSO: 4010/82

LIFE SCIENCES

PROGRESS ON GENETIC ENGINEERING RESEARCH REPORTED

Shanghai JIEFANG RIBAO in Chinese 13 Sep 84 p 1

Article by Wu Yingxi [0702 5391 3356//]

[Text] Eight scientific and technical personnel of the Shanghai Institute of Materia Medica of the Chinese Academy of Sciences, including Yang Shengli [2799 0524 0448] and Wu Ruping [0702 3067 1627], after two years of arduous struggle, successfully developed China's first highly active penicillin acyl enzyme xian hua mei [7913 0553 5326] genetically engineered bacteria. This capability to produce penicillin acyl enzymes from genetically engineered bacteria surpassed that of the genetically engineered bacteria used for production in the Federal Republic of Germany. This achievement opened a channel for our country's application of genetically engineered production of penicillin semicomounds with a wide range of antibiotic capabilities but with minor toxic side-effects, marking a major breakthrough in our conversion of genetic engineering research into production capacity.

Penicillin is an excellent antibiotic with a wide range of capabilities, but after several decades of clinical application, many germs have developed a resistance to it, gravely affecting its healing effect. Although streptomycin, kanamycin, and other new antibiotics were used in clinical application, they could not be widely used because their toxic side-effects were too great. Currently, many nations are modifying the structure of penicillin, using many varieties of penicillin semicomounds with a wide range of antibiotic capabilities but with minor toxic side-effects which are the result of successful genetic engineering research. China's research in this area had been a complete blank.

After returning from advanced study abroad in 1982, Research Associates Yang Shengli and Wu Ruping of the Shanghai Medicinal Research Laboratory conducted investigative research and selected the "Penicillin Acyl Enzyme Genetic Engineering" project which was of major significance to our country's antibiotics industry, and which had also been designated a key research project by the Chinese Academy of Sciences. Those participating in this research are all scientific and technological personnel developed by New China with an average age of only 40 years. Through a concerted effort, and after they successfully cloned genetically engineered penicillin acyl

enzyme bacteria in March 84, they finally succeeded recently in the proliferation and expression of genes.

Specialists concerned revealed that this type of highly active penicillin acyl enzyme bacteria successfully genetically engineered by the Shanghai Medicinal Research Laboratory has entered the intermediate testing phase to expedite its application in production. This will strongly promote technological reform of production in our penicillin industry, bringing with it major economic and social benefits as well.

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LIFE SCIENCES

TERM 'BAREFOOT DOCTOR' EXCHANGED FOR 'RURAL DOCTOR'

OW071200 Beijing XINHUA in English 1152 GMT 7 Feb 85

[Text] Beijing, 7 February (XINHUA)--The Ministry of Public Health has decided the term "barefoot doctor" will no longer be used as a designation for rural health workers.

An official of the ministry told XINHUA today that the term rural doctor will be given to those who pass the secondary medical school qualifying examinations, while other medical workers will be called medical aides.

At present, China has 3.2 million medical workers in the countryside.

The official explained that the term was being changed because it was not a precise enough term for the present rural health workers. The term originally referred to health workers in China's southern villages. In the early 1960's, peasants with a certain level of education were selected to take a short-term basic medical course. Then they acted as part-time peasants and part-time health workers. The peasants worked barefoot in the paddy fields so they came to be called "barefoot doctors."

These people have played an exemplary role in village health and medical work such as environmental sanitatior, health education and immunization. The official said that both rural doctors and medical aides would continue doing the same work.

Peasants found that the medical service offered by these rural health workers was a tremendous boon. So the system was later launched throughout the country.

With the development of medical work in the rural areas, clinics have been set up in villages staffed by two or three barefoot doctors. The majority of them now no longer take part in farming. Some of them have already reached the secondary medical school graduate level, the official said.

He added that measures would soon be taken to give more training to rural doctors and improve their medical service in the countryside.

CSO: 4010/82

LIFE SCIENCES

HOSPITAL STAFFS PROVIDE HOME HEALTH CARE

OW051219 Beijing XINHUA in English 1204 GMT 5 Feb 85

[Text] Beijing, 5 February (XINHUA)--Beijing hospitals provided regular medical care for 22,500 patients at their homes last year, today's BEIJING DAILY reports.

The number was double the figure for 1983, or 58 percent of the 38,580 inpatients which the 100 hospitals in Beijing accommodated last year.

House calls as a supplement to hospitalization are especially popular among the city's patients who suffer from chronic diseases, says the paper.

Most of the city hospitals have set up housecall departments.

Patients receive medicinal, surgical and acupuncture treatment and regular check-ups at their homes, and have their medical records kept at the hospitals like other patients.

They can even have electrocardiograms taken without going to hospital.

House calls, which were introduced in Beijing in 1978, have helped to alleviate the burden on both hospitals and patients' families, the paper said, adding that the city now had an average of one hospital bed for every 240 residents.

CSO: 4010/82

LIFE SCIENCES

CANCER RESEARCH IN GUANGDONG

Guangzhou NANFANG RIBAO in Chinese 24 Sep 84 p 2

[Article by Li Zhenquan [2621 2182 2938], Director, Cancer Hospital, Zhongshan Medical College]

[Text] Since the founding of the PRC, cancer prevention and treatment in our province has developed to a great extent. Development has been even more speedy and particularly since the 11th Plenary Session of the 3rd Party Congress. From medical preventive and treatment personnel, agencies, and equipment to the effectiveness of related achievements in scientific research and treatment, we are currently in a leading position nationwide.

Cancer prevention, treatment, and research agencies were nonexistent in Guangdong before liberation. It was with the emphasis placed upon it and the concern of the Party and the People's Government after the founding of the PRC that they began to develop gradually. Initially, early in 1956, specialized cancer outpatient treatment was established in the Second Hospital of Zhongshan Medical College. In 1958 a Tumor Department was established in the First Hospital of Zhongshan Medical College. On 1 Apr 1964, the Huanan Tumor Hospital (now Tumor Hospital, Zhongshan Medical College) was established with the support of the Public Health Department, and the Guangdong Provincial Party Committee, particularly Comrade Tao Zhu [7118 6999]. In 1964 the Public Health Department also formally approved the establishment of a institute of oncology with primary research responsibility for nose and throat cancer for which the rate of incidence in our province is the world's highest. In 1972 the Provincial Tumor Prevention and Treatment Office was established to plan and arrange the development of tumor prevention and treatment in all areas and municipalities. As of now, the Provincial People's Hospital (which has a radiation treatment laboratory) and area and municipal hospitals in Foshan, Shantou, Shaoguan, Zhaoqing, Hainan, Zhanjiang (established in Gaozhou Xian), Weiyang, Meixian, Shenzhen, Zhongshan, and other locations have tumor and radiation treatment laboratories. According to preliminary statistics there are 437 formally designated tumor treatment beds, and 299 convenience beds. There are 94 specialist physicians and more than 100 nurses. In addition, a cancer research laboratory and a third class cancer prevention base have been established in Zhongshan City and Sihui Xian which have a high incidence of nose and throat cancer, a liver cancer prevention base has been established

in Shunde Xian, cancer of the esophagus prevention bases have been established in Shantou and Nanao, and a stomach cancer prevention base has been established in Yingde Xian. An initial cancer prevention and treatment network has taken shape in our province.

In June 1983, to arouse the enthusiasm of all sectors, and to mobilize and organize personnel zealous in tumor prevention and treatment to promote the development of tumor prevention and treatment in Guangdong, our country's first mass cancer prevention organization--the Guangdong Cancer Prevention Association--was founded. A Cancer Prevention Research Fund was also established, and our country's first cancer prevention journal was published to propagate cancer prevention knowledge to raise the level of consciousness of the broad masses regarding cancer. A cancer prevention outpatient clinic was established in the Tumor Hospital to specialize in developing cancer prevention publicity and providing advice, receiving the masses or persons suspected of having cancer for cancer prevention checkups, or going to the rural areas or to plants to launch mass cancer prevention surveys to provide early detection. In the past three years field surveys have been conducted on 45,936 people, detecting a group of patients in the early stages of cancer of whom 18 with nose and throat cancer did not even realize that they had the cancerous condition, and for whom a cure was effected as a result of timely treatment. The trend toward cancer was prevented by timely prevention in the case of the group detected in the pre-cancer state.

During the past three years our province has scored great successes with respect to research in cancer prevention and treatment. The Tumor Hospital and the Institute of Oncology of the Zhongshan Medical College received awards from the Provincial Science Commission and the Bureau of Higher Education for 21 scientific research achievements. When given timely treatment as a result of early detection of cases of nose and throat cancer through nose and throat cancer serum immunology tests and of liver cancer through the jiatai 3946 5158 albumen test method, the five-year survival rates can reach 80 and 60 percent respectively. With comprehensive radiation and operative treatment of third-stage cancer of the esophagus, the 5-year survival rate can be raised from the former 17.2 percent to 60.1 percent. With radical excision treatment of womb and breast cancer, the 5-year survival rate can reach over 90 percent. These treatment results are already at the advanced level in China as well as abroad. In over three years a four-volume collection of articles on cancer totaling 291 articles, a collection of articles in English, and a volume of abstracts have been published, and 108 articles and abstracts have been printed in periodicals. In 1983, the first book of monographs in the country on "Clinical and Experimental Research on Nose and Throat Cancer" was collectively compiled and published. After national appraisal and comparison, it received the 1983 Class 1 National Award for Excellence in Scientific Literature. That publication summed up the achievements in more than 20 years of research on nose and throat cancer by our various cancer prevention and treatment units, particularly the Zhongshan Medical College and its subsidiary Tumor Hospital and Oncology Institute, for example, the epidemiology of nose and throat cancer in our province, early diagnosis, the relationship between mucous membrane proliferation and canceration, radiation

treatment, and other areas of significant achievement. These accomplishments were reported on numerous occasions during academic exchanges at international conferences on cancer as well as at international academic exchanges sponsored by many countries, evoking strong responses. In 1982 the provincial departments concerned further formally published the magazine "Cancer" for distribution in China as well as abroad, and ten issues of the second volume have already been published. From 1981 on, the World Health Organization designated the Oncology Institute of the Zhongshan Medical College as one of the World Health Organization's cancer research cooperative centers; it has played the role of promoting and advancing nose and throat cancer research in some countries.

Tumor prevention and treatment in Guangdong is developing rapidly while in the process of reform. Since the 11th Plenary Session of the 3rd Party Congress, various units have carried out a series of reforms centered on the problem of how to develop the enthusiasm of cancer prevention and treatment personnel to concentrate on serving the afflicted ones. The Tumor Hospital of the Zhongshan Medical College in October 1980 implemented the specialist treatment hospital and carried out structural reforms, adopting the secretarial system not withdrawn from duties, and simplifying the organization. They conscientiously implemented the policy on intellectuals, they diligently improved their medical treatment, instruction, scientific research, and living conditions. Recently they built, expanded, and modified medical treatment, instruction, and research sites and dormitories totaling 20,000 square meters, more than doubling the original floor space in use. At the same time, they also introduced successively from abroad advanced cancer diagnostic and treatment equipment. These included the whole-body computer tomography (CT), linear accelerator, radiation treatment simulator, B ultrasonic waves, Cobalt 60 treatment machine, biochemical analyzer, artificial respirators, monitors, electronic computers, anesthesia machines, etc. To better develop the specialties of certain medical personnel, senior physicians set up practices involving outpatient care and house calls on the basis of their specialties to facilitate their continuous summing up of their treatment experience, further raising the level of treatment of treatment, promoting a rise in the quality of outpatient treatment. Among the broad masses of medical personnel, a system of personal responsibility was put into general practice. In 1983 the number of outpatient visits reached 140,181, a 27.2-percent increase over 1980. The quality of service continued to rise. The following are several principal index ratios: the recovery rate was 29.75 percent in 1980, rising to 30.86 percent in 1983; and the improvement rate was 34.36 percent in 1980, rising to 42.5 percent in 1983.

Currently all tumor prevention and treatment units and departments in Guangdong are, in accordance with the requirements of our cadres' four modernizations, restructuring leadership and making bold reforms, and are determined to create a new tumor prevention and treatment situation in our province to welcome by practical activity the Thirty-fifth Anniversary of the Founding of the Nation.

8174
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LIFE SCIENCES

MORE PRIVATE DOCTORS REGISTERED IN BEIJING

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[Text] Beijing, 9 Feb (XINHUA)--There were 768 private doctors, dentists and nurses registered in Beijing at the end of last year, the municipal bureau of public health said here today.

Last December, 273 of them obtained licenses after passing examinations.

Medical services in various forms are provided jointly by the state, collectives and individuals, a bureau official said.

Over the past few years, the number of private clinics had increased greatly after the municipal government decided to make full use of the medical skills of retired people, or those not affiliated with hospitals.

Private doctors were mainly concentrated in urban and suburban areas. Two thirds of them specialized in traditional Chinese medicine, with the rest trained in Western medicine, dentistry, nursing and midwifery.

Many had mastered special diagnostic techniques handed down in their families or taught by older doctors. Some were skillful in acupuncture and massage. Some acquired professional knowledge from books or special classes, and others had retired from local medical institutions.

When the municipal bureau decided to test those wanting licenses in December, more than 800 applicants signed up. Finally, 273 passed the exams, which involved basic medical theories, prescriptions and pharmacology. Each applicant was required to treat three different cases, write out therapies and clinical practices and pass oral tests.

Experienced doctors over the age of 60 had only to take part in clinical practice tests.

Private doctors are visited at home by patients, and occasionally make house calls. Herbalists doctors also work in Chinese drugstore clinics. The patient can buy medicine as soon as he or she received a prescription.

Pirvate doctors charge the same prices as state-run hospitals and pay no taxes.

Retired doctors and nurses are still able to enjoy their welfare benefits and pension after starting their own clinics.

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6 March 1985

MICROCIRCULATION RESEARCH ADVANCES TO NEW LEVELS

Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese No 1,
15 Jan 84 pp 1-2

[Article by Chen Wenjie [7115 2429 2638], Institute of Hematology, Chinese
Academy of Medical Sciences]

[Text] Following continuing developments in microcirculation research, medical professionals have become increasingly aware of the important significance of this field on theoretical research in the medical sciences, and its practical application. Not only does the microcirculation assure normal metabolism in tissues and maintain homeostasis in the human body, it also participates in and completes specific organ function in certain instances. For this reason, in the study of many physiological and pathological processes of the human body, the microcirculation has become an important and essential aspect that cannot be overlooked.

In recent years, microcirculation research has attracted the interest and attention of specialists in the fields of biomedical engineering, biomechanics, and biophysics. They have produced up-to-date instruments and equipment to study the physiology and pathology of the microcirculation, and provided valuable quantitative methods and scientific data for microcirculation research to attain a new level of achievement.

Ever since the 1960's, clinical microcirculation research in China has accumulated a great amount of experience and data, and has provided direction in the treatment of certain diseases (such as infectious septic shock, fulminating meningitis, toxic dysentery etc.) with dramatic improvement. At the same time, experimental microcirculation research was also begun. A considerable amount of clinical practice has proven that specific changes in the microcirculation at the body's periphery (nail folds, bulboconjunctiva) are not great, though individual differences are greater. For this reason, the value of these differences as diagnostic indicators is limited. However, to a certain extent, they do reflect microcirculation changes within the body. Observations of microcirculation dynamics in a particular individual during different stages of an illness are of definite reference value for predicting the course of the disease, and for providing some indication in clinical treatment. It must be pointed out that in the process of compiling and editing the valuable pharmacopeia of traditional Chinese medicine, we found that microcirculation and hemorheology research provides some sound theoretical and objective indications for practicing traditional Chinese and western medicine together, as many blood tonics, stasis-relieving drugs and derivatives of *Hyoscyamus niger* [black henbane] can improve the microcirculation and changes in its blood flow state. These findings have greatly stimulated research in microcirculation pharmaceuticals with a distinctive traditional Chinese medicine character.

At any rate, great strides have been taken in microcirculation research in China during the last two decades with outstanding results. However, when compared with results of accomplishments made on advanced international levels, the distance is still great. Improvements and intensive efforts must be made, particularly in the following areas:

1. Clinical microcirculation research in China has generally stopped at the morphological observation and identification phase. Future efforts must coordinate with research and development of new instrumentation and new equipment in the direction of quantitation, and explore in depth the specific changes and the pathophysiological basis of morphological changes during the course of disease.
2. The chief object of clinical observations at present is the peripheral microcirculation. Future efforts must expand research studies of organ microcirculation on a large scale, particularly to study the interrelationship between changes in the microcirculation at the body surfaces and that in the internal organs. Such observations will be of important reference value to the diagnosis, treatment, and prognosis of disease.
3. The methodology and standards used by various groups in China engaged in microcirculation research are not consistent, just as the terminology used by them is not uniform. While a large amount of data has been accumulated overall, it is difficult for these groups to compare data or make any reference to each other. There is an urgent need to standardize observation methodology and the terminology used.
4. Few studies are being done on the changes and function in the microcirculation and its hemorheology under typical pathological conditions. Future efforts should actively pursue studies of microcirculation changes in basic pathological states during the course of cellular proliferation, inflammatory disease, edema, aging, tumor growth and metastasis, and shock. Following further research into these areas, a new understanding and new treatment measures for these basic pathological states will evolve.
5. Microcirculation function and morphological changes must be studied together with hemorheology to analyze the interaction and interrelationship between changes in the microvessels and blood cell flow and deformation. Only through such study can a further understanding of the microcirculation be had.
6. Research on microcirculation pharmaceuticals should be strengthened, especially further exploration into the principle of drug action pertaining to blood tonics, stasis-relieving agents, and derivatives of *Hyoscyamus niger*. In particular, these studies must combine with those studying the neural control of the fluid-regulation mechanism in the microcirculation, to develop gradually in the direction of molecular pharmacology research.
7. To develop experimental studies of the microcirculation even more effectively, research models and corresponding experimental animal models must be set up. Developing long-term experimental models for research is particularly important.

At the beginning of a new year, we expect the large cadre of professionals engaged in microcirculation research will further strengthen the close collaboration between the various scientific disciplines and that between clinical and

laboratory research. By doing so, they will further develop the commanding position that China's microcirculation research holds, and will promote increased collaboration between traditional Chinese and western medicine and seriously effect their combined practice, to ultimately improve the quality of microcirculation research in China.

5292

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LIFE SCIENCES

SUMMARY OF FIRST SEMINAR ON MICROCIRCULATION

Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese
No 1, 15 Jan 84 pp 3-9

[Text] The first seminar on microcirculation sponsored by the Chinese Pathophysiological Society of the Chinese Association of Physiological Sciences was held 5-9 September 1983 in Tianjin. The 89 participants, representing China's 25 provinces, municipalities, autonomous regions, and various garrisons, include specialists from the fields of pathophysiology, clinical medicine, and engineering engaged in microcirculation research. A total of 125 papers and data reports related to microcirculation were received. The meeting was conducted in seminar format, with the participants expounding in great length and depth.

The main topics of discussion were (1) clinical application of in vivo microcirculation observations; (2) the physiology, pathophysiology, and pharmacology of microcirculation regulation; (3) methodology and indications for human microcirculation observations; (4) visceral microcirculation studies; (5) microcirculation and hemorheology; (6) application of new techniques and methodologies in microcirculation research; and (7) standardization of nomenclature and terminology used in microcirculation research. During the meeting, the Wuhan Microcirculation Society described their experiences in developing a program of scientific exchange. The important highlights of this seminar are summarized below.

I. The Clinical Application of In Vivo Microcirculation Observations

Microcirculation study has been a marginal multidisciplinary science that has been used in clinical medicine only in the last 20 years. In China, Li Zhi-shan (2621 1807 1472), Chen Wenjie (7115 2429 2638) et al first reported in 1964 on the clinical use of inspecting the microcirculation in the finger nail folds. In the last decade, on the basis of microcirculation studies in animals, in vivo microcirculation studies in humans have been initiated in China on a broad scale. Among the 125 papers received at this meeting, 45 percent of them were clinically related, and covered a broad field that included clinical microcirculation observation of diseases treated in internal medicine, surgery, pediatrics, dermatology etc. Some even involved human microcirculation studies in presence of treatment by traditional Chinese medicine anesthesia, acupuncture, respiratory therapy [exercises] etc.

In using clinical in vivo microcirculation observations as a diagnostic aid in medicine, the First Hospital of the Hubei Medical College had done some work. In accordance with basic pathophysiology theory, researchers there have used in vivo microcirculation observation as a non-traumatic examination technique in clinical surgery, and used the microcirculation microscope to observe the microcirculatory state of the corresponding part in disease, and thereby, have

coordinated pathophysiologic characteristics of the microcirculation to serve as a diagnostic aid for certain diseases. Should this technique be used on patients undergoing retransplantation of a severed limb, continuous observation of its nail-fold microcirculation at time of surgery and for 48 hours thereafter will show whether or not the blood-vessel anastomosis was successful.

Observation of the mesenteric and intestinal microcirculation is also used in like manner to help determine the extent of intestinal resection in intestinal gangrene. When amputation is being considered for patients with thromboangiitis obliterans, whether or not a viable microcirculation is present is the deciding factor. Examination of the skin microcirculation in the affected limb and observations on the extent of the inflammation and the size of the thrombosed area help decide how much to amputate. In skin transplantation for burn patients and plastic surgery patients, the presence of patent microvessels in the skin as observed by the microcirculation microscope will determine whether or not the transplant is viable. In these situations, when changes in the microcirculation morphology, flow dynamics, function, bleeding etc., must be observed in the periphery of the affected side, they must also be observed in the periphery of the healthy side.

Researchers from the Institute of Dermatology of the Shanghai First Medical College reported on observations of the local microcirculation in two cases of Reiter's disease characterized by accompanying silvery scale skin lesions. They discovered that the microcirculatory blood vessels were not seen in spherical clusters, and were obviously different from the typical spherical clusters evident in microcirculatory blood vessels of local skin lesions in arthritic psoriasis. Clinically, these two diseases are difficult to differentiate. For this reason, observation of the local skin lesion microcirculation can provide an important basis for a differential diagnosis. Furthermore, the technique is simple and the results are certain. Researchers there also observed the microcirculation in the nail fold, tip of the tongue, and the buccal mucous membrane. They found that changes in the morphology, flow dynamics, and permeability here are related to the illness duration--the longer the illness duration, the more severe the changes. The results were consistent in all three body locations.

Researchers from the Institute of Hematology of the Chinese Academy of Medical Sciences also reported on their observations of nail-fold microcirculation in 99 cases of systemic sclerosis, 13 cases of local scleroderma and 23 cases of scleroderma. They discovered that the nail-fold microcirculation in all three of these conditions showed variation, and did not depend on the presence of Reynaud's phenomenon or sclerodactyl, nor on the extent of skin hardening, though they did aid in the differential diagnosis of these three illness types. Moreover, through nail-fold microcirculation observations, peripheral blood flow mapping, electron microscopy of skin tissue, and analysis of angioplasty effectiveness, obstruction in the microcirculation has been found to be a central link in the disease mechanism of systemic sclerosis.

On the basis of their work at the Institute of Pediatrics of the Chinese Academy of Medical Sciences and reports in the foreign literature, institute researchers also commented on peripheral microcirculatory changes in coronary disease patients and the significance of these changes. They recognized the following:

- (1) Coronary heart disease is a systemic vascular regressive disease affecting the whole body, where the capillary vessels, as well as the muscular vessels,

show endothelial thickening--that is, they are PAS-positive.

(2) Most epidemiologic and clinical data show an orderly relationship between coronary heart disease and retrogressive disease changes in the peripheral microcirculation. For example, the extent of abnormality in the peripheral circulation largely parallels the extent of myocardial insufficiency and damage as indicated by an electrocardiogram in coronary heart disease, as well as by the patient's state of cardiac function (maximum work tolerance).

(3) Comparison of coronary angiograms or results of postmortem examination with in vivo examination of peripheral microcirculation shows that no moderate or drastic changes are noted in the peripheral circulation of anyone with normal coronary arteries. On the contrary, during the course of coronary disease progression, none of the severe cases show a normal peripheral microcirculation.

(4) The severity of angina felt and the dynamics of the peripheral microcirculation are related, where the severity of the chest pain and the inadequate flow in the microcirculation are directly proportional. During the course of illness, when the angina increases or decreases, perfusing flow conditions in the peripheral microcirculation also show corresponding changes.

As to how examination of the microcirculation in the human body is clinically significant in coronary heart disease, several possibilities are recognized as follows: (1) It aids in the early discovery of arteriosclerosis. For example, in 259 cases of arteriosclerosis in whom ophthalmoscopic examination of the retina was negative, various peripheral microcirculatory changes were noted, with a positive rate possibly as high as 40 percent. Among numerous changes, vessel narrowing alongside arteries and vessel dilation alongside veins, and obvious or increased blood cell aggregation after a fatty meal were more significant, though they lacked specificity. (2) It definitely supplements coronary heart disease diagnosis. If myocardial insufficiency is suspected on the basis of symptoms and electrocardiogram findings, and the peripheral microcirculation examination is not completely normal, then the diagnosis of coronary atherosclerosis can be eliminated, and causes of the angina and electrogram changes should be looked for elsewhere. On the other hand, when angina and electrocardiogram abnormalities appear at the same time, and the peripheral microcirculation shows serious unusual changes, then the possibility of coronary heart disease should not be dispelled. (3) It can be used as a hunch to estimate the amount of atherosclerotic change in the coronary arteries and the extent of myocardial damage. Work in this area requires further exploration. (4) It can be used as an indicator of myocardial infarction and cardiogenic shock, to help determine whether therapy has been effective and to project a prognosis.

Attendees from the Xuzhou Regional Hospital reported on cystlike changes in the bulbo-conjunctival microvessels in ischemic heart disease. They feel that small vessel hemangiomas are the result of degenerative changes in the blood vessels which are influenced by the severity of the disease. Changes in the aggregate flow dynamics of red cells in the microcirculatory blood flow play an important role in diagnosing cardiovascular disease. Furthermore, workers at this hospital have discovered that during the full course of hemorrhagic fever, in addition to microcirculatory obstruction, blood seepage also appears and capillary brittleness increases.

Medical workers at the Fourth Hospital of Wuhan also observed that among changes in the nail-fold microcirculation of patients suffering from cardiopulmonary

disease, "short rod-type" vessel junctions appeared during the acute stage, accompanied by blood seepage and bleeding.

Workers from the Department of Pediatrics at the Guangxi Medical College Hospital reported on the nail-fold microcirculation changes in 13 pediatric cases of pneumonia complicated by cardiac failure. They discovered a decrease in the number of capillary loops, a shortening of arterial branches, and a narrowing of the vessel lumen, while the venous branches became more convoluted and longer, with a slowed blood flow and an aggregation of red cells. They conjectured that the small blood vessels of the whole body had been placed in a spastic state, with the peripheral resistance increased. For this reason, they used vascular dilators to relieve angina with good results, and the nail-fold microcirculation also showed improvement.

At the Headquarters Hospital of the Chinese Liberation Army, workers there had observed the nail-fold microcirculation of 285 patients with frequently seen illnesses. The appearance of abnormally shaped vessel junctions were commonly seen in chronic illnesses such as coronary heart disease, chronic nephritis, chronic hepatitis, and kidney syndromes. But the peripheral microcirculation in acute diseases such as acute nephritis, toxic dysentery, angina etc., showed an obvious narrowing in the terminal arterioles.

A survey of the nail-fold microcirculation in 400 patients at the Guangzhou Garrison Hospital of the Chinese People's Liberation Army classified its morphology into four basic types: normal, spastic, stagnant, and dilated. Generally, most spastic types were allied with acute illnesses, the stagnant types mostly with chronic illnesses, and the dilated types usually with the microcirculatory apparatus being weighed down by the slowed down blood flow during the progression of chronic illness, particularly where vascular swelling occurs in the blood-carrying vessel wall and its regulatory function is impaired.

In the application of in vivo microcirculation observations to evaluate disease, workers from the First Hospital of the Hubei Medical College reported on their observations of the conjunctival microcirculation to monitor resuscitation of patients with sudden cardiac arrest. Direct visual examination of the peripheral microcirculation--that is, observation of the blood flow and lumen changes in the small conjunctival microvessels, during extracorporeal circulation in open heart surgery helps determine tissue perfusion conditions with extracorporeal circulation, so that the perfusing flow volume of the heart-lung machine can be regulated. This method is considered to be nontraumatic, simple, and effective. Moreover, these researchers also found that the peripheral microvessels in patients with large-scale burns and suffering from shock, showed obvious changes manifested as terminal arteriolar contractions, a smaller arterial/venous ratio ($<1:1.5$), and blood cell aggregation in the microvascular blood flow. For this reason, peripheral microcirculation observations can be used to help monitor disease progression and assess treatment results.

Specialists from the Tianjin Municipal Institute of Traditional Chinese and Western Medicine to Treat Acute Abdominal Conditions reported on their use of nail-fold microcirculation observations to assess the efficacy of laser acupuncture to treat 50 cases of appendicitis accompanied by perforation. Increased numbers of microvessel junctions in the nail-fold microcirculation and increases in the blood velocity are indicators of a change for the better. These researchers feel that these are objective indicators which have practical value for disease assessment.

Besides these studies, medical specialists at the Guangzhou Garrison Medical School of the Chinese People's Liberation Army reported on their use of nail-fold microcirculation observations to help assess the drug stability of daturine (alkaloid from plant Datura metel) during combined anesthesia in surgery.

Workers at the Zhejiang Provincial People's Hospital reported on observations of the microcirculation in the conjunctiva and nail fold to assess and explore the therapeutic mechanism of blood activation to relieve stasis, a technique used to treat venous obstruction in the retina. They discovered that microcirculatory obstruction is manifested chiefly as red cell aggregation in the microcirculatory apparatus and local blood stasis, which are improved after blood activation.

In the area of drug therapy to improve the microcirculation and open up obstructed blood vessels, specialists from the Jiangsu Provincial Institute of Traditional Chinese Medicine reported on the intravenous use of "797"(a prescription of traditional Chinese drugs) to treat thromboangiitis, polyarteritis, cerebral thrombosis, thrombophlebitis etc., with good results. Its efficacy was consistent with a basic improvement in the microcirculation.

A report from the Air Force Headquarters Hospital of the Chinese People's Liberation Army described the primary use of 654-2 in comprehensive treatment of one case of severe diabetes complicated by a gangrenous foot, with outstanding results. After treatment, the nail-fold microcirculation showed obvious improvement, the blood sugar dropped, and the gangrene was cured.

Besides all these were reports from several other hospitals. The Guangxi Medical College reported on use of "xiao-xin-tong" (3194 1800 4027) [angina reliever] to treat pneumonia in small children. The Zhejiang Provincial People's Hospital reported on the use of traditional Chinese herbs and ureakinase to treat venous obstruction in the central vein of the retina. The Institute of Acupuncture Research of the Academy of Traditional Chinese Medicine reported on needle puncture of points such as the tanzhong (5238 0022), jujie (1565 0628) etc., to treat acute myocardial infarction, while observing the peripheral microcirculation at the same time. Treatment efficacy was consistent with improvement in the peripheral microcirculation.

II. The Physiology, Pathology, and Pharmacology of Microcirculation Regulation

A report from the Pathophysiology Laboratory of the Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences, was entitled The Physiology, Pathology and Pharmacology of Microcirculation Regulation. It combined research at the laboratory and findings from the foreign medical literature which indicate that neural and fluid control of the microvessels and their local regulation not only assure a needed blood supply for organ and tissue nutrition, they also meet the needs for active organ and tissue function. Besides direct use of the electron microscope or histochemical techniques to study nerve distribution in the microcirculatory apparatus, receptor antagonists or blockers can be used singly or jointly to observe changes in the diameter (or lumen size) of different microvessels, to explore the distribution of receptors in them. Use of these two techniques abroad have proved that comparison of precapillary venules and terminal arterioles shows a rare distribution of vegetative nerves, a weak reaction to catecholamine which cannot be suppressed by adrenergic blockers. This laboratory and the Laboratory of Microcirculation Research in the Department of Internal Medicine at the Tongren Hospital in Beijing discovered jointly that

the contractile reaction of microvessel lumens to noradrenalin in the cheek pouch of hamsters shows the capillaries larger than the terminal arterioles, and the terminal arterioles larger than the postcapillary venules. Present studies abroad on the distribution of microvascular receptors are moving forward rapidly. These studies have discovered that alpha receptors cause the vascular smooth muscle to contract, while beta receptors cause it to relax. Beta receptors in terminal arterioles change with age, in that the increased reaction of the young hamster to isoproterenol is more marked, that in the more mature hamster is weaker, and that in the old hamster is nil. However, no such phenomenon is seen in the postcapillary venules, and the alpha receptors are not affected by age. The distribution of adrenergic receptors in different blood vessels of different organ structures also varies. For example, in bone and muscle, where alpha and beta receptors are found in resistance blood vessels, only alpha receptors are found in volume blood vessels; and where alpha and beta receptors are found in the portal artery, alpha receptors only are found in the portal vein.

The Pathophysiology Laboratory of the Institute of Basic Medical Sciences of the Chinese Academy of Medical Sciences reported on the work done by the Sandoz Laboratories of Switzerland, where use of radionuclides and radioactive self-imaging techniques found ten times more beta receptors than alpha receptors in the lungs of large hamsters; with more beta receptors in the bronchial tubes than in the blood vessels, and more alpha receptors in the blood vessels than in the bronchial tubes.

Present studies on the local regulation of the microcirculation are mostly concerned with myogenic regulation and metabolic control, which recognizes the direct relationship between blood flow volume and tissue metabolism. For example, in ischemia, the increase in carbon dioxide, lactate and cysteine, and a drop in blood oxygen can cause an increase in blood vessel dilation and blood flow compensation. The purpose of this is to stabilize the blood flow.

Cyclic changes in the diameter of terminal arterioles (and the precapillary sphincter), that is "blood vessel movements," have been noted early on. Documented studies in recent years on these continuous vessel-diameter changes in the microvasculature have led to a better understanding of their physiologic and pathophysiologic significance. In hamsters recovered from the side effects of anesthesia and surgery, it was discovered through a cutaneous "window" that blood in the terminal arterioles whose diameters showed no periodic contractions was unable to reach the capillaries under their control. Only where the diameters of terminal arterioles showed periodic changes was blood flow noted in the capillaries they fed into. This is an indication that blood vessel movement can exert an even finer control over capillary blood flow. As to its pathological significance, it was found that rhythmic changes in the diameters of terminal arterioles were related to the resistance at the blood vessels' external circumference. Whether or not the pathological obstruction is a factor in hypertension is a hypothesis being studied in models of rats with spontaneous hypertension.

In joint studies conducted by the Pathophysiology Laboratory of the Institute of Basic Medical Sciences of the Chinese Academy of Medical Sciences and the Microcirculation Laboratory of the Department of Medicine at the Tongren Hospital in Beijing, researchers used the double-window technique to measure blood flow velocity in microvessels. Their results showed rhythmic changes. In the nail-fold microvessels of 67 normal persons, the number of times that the blood

velocity per minute showed marked increase, the average figure was 8.5 ± 5.7 times/min (close to the number of blood vessel movements reported by Davis, and approximating changes in flow velocity in the nail-fold microcirculation of $6 \sim 10$ times/min). This phenomenon was also seen in the cheek pouch terminal arterioles, postcapillary venules, and capillaries of hamsters, with the averages for these blood vessels in 27 animals as 13.1 ± 1.4 , 13.6 ± 1.4 and 12.7 ± 1.6 times/min, respectively. Statistical treatment of different blood vessels and findings between man and hamster have shown no obvious differences. Whether or not this has the same physiological significance with respect to blood vessel movement requires further exploration.

The Microcirculation Laboratory at Tongren Hospital also discovered that in liver cirrhosis patients where the blood velocity showed a marked increase, the number of times it did so was reduced by 1.8 ± 0.7 times/min. At the same time, the basic blood velocity was also lower than that in normal persons. Future efforts should include more diseases to be studied for their pathological and physiological significance.

It can be seen from these reports that blood vessel diameter size and blood velocity are frequently used as indicators for studying the reaction of microvessels to stimuli, as well as the pathology and physiology of microvessel regulation. They can also be used to calculate the blood flow volume, that is

$Q = \pi r^2 \cdot V$, where Q is blood flow volume, r is the blood vessel radius, and V is the blood velocity within the microvessel. Because of developments in quantitative measurement of the diameter size and velocity changes, studies in this area have experienced a new surge forward. It was also discovered that automatic measurement of blood velocity frequently measured only the median velocity in the blood vessel. According to the experimental formula, the above equation should also be divided by 1.6. That is $Q = \pi r^2 \cdot V_c / 1.6$, where V_c is the velocity at the median of the blood vessel.

Drug studies on microcirculation function also observe the effect of drugs on microvessel diameter size and blood velocity. Collaboration between the Pathophysiology Laboratory of the Institute of Basic Medical Sciences and the Microcirculation Laboratory at Beijing's Tongren Hospital used television to show how microvessel diameters are measured, and how the double-window technique determines velocity in studies on the effect of traditional Chinese drugs such as Conioselinum univattum, Salvia multiorrhiza, and Astragalus henryi (with physiologic saline as the control) on the microcirculation of the hamster's cheek pouch. They found that after noradrenalin was used locally, the diameters of capillaries, terminal arterioles, and postcapillary venules contracted, and blood velocity and blood volume dropped. However, after these traditional Chinese drugs were used, the vessel diameters would open again, and blood velocity and blood volume both increased. Comparison of these results with that from controls using physiologic saline found obvious or markedly obvious differences, though use of Astragalus henryi was unable to improve the velocity and volume of blood. Preliminary indications are that the effects of "energy beneficial" and "blood tonic" drugs on the microcirculation may vary, and the efficacy of Astragalus henryi may be derived through another mechanism. To compare the action of different drugs, and in particular, to eliminate the different reactions caused by different dosages, a method for determining the 50 percent reaction point (EC_{50}) is suggested. That is, to determine the diameter changes in the micro-

vessels of an in vivo sample, it is subjected to action of drugs in different concentrations, until a maximum reaction is attained, and a dosage concentration reaction curve is plotted to find EC₅₀, for comparison with the EC₅₀ of different drugs. It is also possible to inject drugs of different concentrations intra-dermally to determine the seepage of intravenous pigment or radioactive macromolecular indicators (tags), and plot a concentration reaction curve to find EC₅₀. This principle may be used to make quantitative comparisons of the effects of various drugs on microvessel diameters, blood velocity, and vessel wall permeability.

Information exchange and discussions on the problem of microcirculation regulation were also held at the meeting. The consensus was that with further developments in quantitative techniques and instruments to measure microvessel diameter size and check blood flow velocity, research in this area will continue to move forward.

Researchers from the Shanghai College of Traditional Chinese Medicine reported on photoscanning techniques using microscopic video to measure microvessel diameters, and the dual-slit method to measure flow velocities. They discovered that after subcutaneous injection of isoprotenerol, microvessels in the rat mesentery experienced dilation in their diameters and reduced velocity in their blood flow, which returned to normal after 10 minutes, but the diameter dilation continued. Experiments conducted by another group showed the flow velocity in the mesenteric microvessels of the rat to be slow throughout, lasting from 30 minutes to 2 hours. A two-lead electrocardiogram showed a steady T wave peak, or an elevation in the ST segment 3~5 minutes postinjection. Sacrificing the animal 2 hours later showed anoxic changes in the myocardial cells. Comparison of microvessels after extract of motherwort (Leonurus heterophyllus) had been used with those after physiologic saline use showed improvement in diameter contraction and flow velocity in the former, and the electrocardiogram which had depicted anoxia showed a change toward marked improvement or return to normal.

The Pathophysiology Teaching and Research Section of the First Army Medical College of the Chinese People's Liberation Army reported on work conducted at the University of California/San Diego where an electron-imaging shear response technique to measure microvessel diameter, and a dual-tube technique to measure flow velocity of red cells were used to study the microvascular regulatory mechanism in the rat skeletal muscle during irreversible hemorrhagic shock. After severe shock had been induced following loss of blood from the animal's femoral artery, the second and third degree arteriolar and venular microvessels in the cremaster muscle were seen to contract, and flow velocity and blood volume were both markedly diminished. Following blood transfusion, the arterial pressure in this group rose to approximate that of the controls, but the blood pressure in the surviving group continued to stabilize while that in the non-surviving group dropped gradually. Two hours after blood transfusion, blood pressure in the surviving group returned to normal, diameters in the second degree terminal arterioles had basically recovered, and flow velocity was increased. In the non-surviving group, the blood pressure remained low, the second degree terminal arterioles were still lower than that in controls by 22 percent, and blood flow volume was 74 percent lower than that in the controls. Moreover, the third degree terminal arterioles showed a markedly slower reaction to adrenalin, such that the adrenalin concentration needed to be increased ten times to precipitate any contraction. For this reason, it was felt that animals given blood transfusions after irreversible hemorrhagic shock experience a period when the blood

pressure goes up but the microcirculation has not fully recovered. During this time, their muscular microvessels contract, peripheral resistance is increased, and the microcirculatory blood volume is markedly diminished, indicating an inadequate cardiac output, which in turn stimulates the sympathetic nervous system. Following this, the vascular catecholamine reaction is diminished, which hastens blood pressure drop and microcirculatory prostration.

Researchers at the Beijing Friendship Hospital and the Microcirculation Laboratory of the Beijing Institute of Clinical Medicine reported on rabbit experiments to produce hemorrhagic enteritis models. Endotoxin was injected under the serous coat of small intestine in domestic rabbits, followed 20 hours later by another injection of endotoxin intravenously, which produced blood stasis, edema, and bleeding in the initial injection site. Or, 24 hours after initial endotoxin injection in the intestine, an intravenous injection of noradrenalin was given to produce an identical model of hemorrhagic enteritis. If phentolamine had been administered first to block the alpha receptors, followed by administration of noradrenalin, the phenomenon described above would not have occurred. The experiment results support the view that hemorrhagic enteritis is an obstruction in the microcirculation. It is felt that after endotoxin damage caused a rise in alpha-receptor reactivity in the small local blood vessels, should catecholamine release also occur leading possibly to a systemic microcirculation obstruction concentrated chiefly in the intestines, alpha-receptor blockers such as phentolamine may be the effective drug for clinical treatment of acute hemorrhagic enteritis. These two experiments clearly explain the significance of microcirculation regulation in disease etiology. Research in this area should be heightened, and drugs that can correct microcirculatory obstruction should be further explored.

Research into traditional Chinese drugs, particularly the effect of stasis-resolving blood tonics on the microcirculation, has been attracting wide attention. While techniques such as video imaging and automatic measurement of flow velocity are not available to any research group without conditions, other techniques such as photographic measurement of diameter size or light synchronized scanning to estimate flow velocity or observe flow changes are being initiated in research studies which may yield significant results. For example, the Pharmaceutical Laboratory of the Jiangsu Provincial Institute of Traditional Chinese Medicine reported on research into an effective traditional Chinese drug compound "797" used to treat obstructive inflammatory conditions in the peripheral vasculature, and found that it could cause microvessel dilation and increased blood flow in the toad mesentery. It was also found to alleviate the microcirculatory obstruction caused by high molecules of anhydrous dextran in the rabbit bulbar conjunctiva, and increased flow velocity and improved flow conditions.

Workers from the Physiology Teaching and Research Laboratory at the Hunan College of Traditional Chinese Medicine reported on use of a drug compound consisting of Salvia multiorrhiza and Aquilaria agallocha which relieved the microcirculatory obstruction in the bulbar conjunctiva of domestic rabbits after endotoxin injection, and improved blood flow, blood cell aggregation and vascular patency.

At the Institute of Industrial Hygiene of the Shanghai First Medical College, workers discovered that extract of Salvia multiorrhiza was able to relieve noradrenalin-caused aortic contraction in the rat, which helps explain the herb's role in improving the microcirculation.

Discussions at the meeting also focused on methodologies used to study the effect of drugs on the microcirculation, and noted that preparation of in vivo micro-vessel samples for testing local-use drugs must consider the effect of various factors such as humidity, temperature, acidity, capillary pressure etc., of the sample. However, the advantage is direct observation of the effect of drugs on the microvessels, and this approach is still used extensively. Though systemic drugs can reduce the effect of such local factors, they can affect the heart and larger blood vessels at the same time they affect the microvessels. A safe method is to use both local and systemic drugs. Furthermore, experience has proved that clinical results are more easily noted when drugs taken orally are found effective.

Researchers at the Pathophysiology Laboratory of the Institute of Basic Medical Sciences at the Chinese Academy of Medical Sciences, and the Microcirculation Laboratory of the Department of Internal Medicine at the Beijing Tongren Hospital also observed the blood velocities in arteriolar microvessels, venular microvessels, and capillaries in the cheek pouch of the hamster on the television screen. They compared the results with the measured flow velocities, and found a definite relationship between the two. During linear flow, the velocities in the arteriolar and venular microvessels were 0.46 ± 0.13 and 0.43 ± 0.08 , respectively. Because a number of cases were not recorded (limitations in instrument speed in the upper range) during linear flow, the actual figures were greater than these values. During linear-granular flow, the velocities for the arteriolar microvessels, venular microvessels and capillaries were 0.37 ± 0.12 , 0.36 ± 0.11 , and 0.33 ± 0.10 , respectively; during granular flow, they were 0.29 ± 0.12 , 0.29 ± 0.11 , and 0.27 ± 0.11 , respectively; and during granular-slow flow, they were 0.21 ± 0.08 , 0.20 ± 0.12 , and 0.14 ± 0.11 , respectively (in mm/sec). These figures may be used as points of reference for estimating the blood velocity under different flow conditions.

Researchers at the Pharmacology Teaching and Research Laboratory of the Chungshan Medical College used temperature rise in the mouse ear lobe as an indicator of improved microcirculation and vascular dilation in studying the effects of several drugs. They discovered that atropine (by gastric infusion), 654-2 (by gastric infusion), benztrapine (by subcutaneous and intra-abdominal injection), and 3-7 saponin (subcutaneous, intravenous and intra-abdominal injection) all cause the cause the skin temperature to rise, though an increased dose of the latter agent given only intravenously will produce a counter effect.

Electron microscopic observations in recent years have discovered that histamine and bradykinin can cause increased vascular permeability most markedly in the postcapillary venules, and interstitial spaces between the endothelial cells are increased. Beta-receptor activators can inhibit the increase in permeability just described, and cause the interstitial spaces to shrink. The occurrence of endothelial cell contraction is seen mostly in postcapillary venules, so if histamine can cause contraction here to increase the interstitial spaces between endothelial cells, a beta activator can cause cell dilation to shrink these same spaces. Possibly, it is through the relaxation-contraction of vascular cells that beta receptors control the permeability of macromolecular substances in blood vessels. Further research should be explored here, particularly for drugs that can decrease permeability.

III. Methodology and Guidelines for Observing the Microcirculation in the Human Body

A routine tool used in observation of the human microcirculation is the microscope which can perform non-invasive *in vivo* studies of certain surface body parts. The nail fold, the conjunctiva, and the tip of the tongue are the most common sites used for study in China at present. However, the observation methods, guidelines, instruments and techniques used at various locations have not been consistent. This in turn affects observation results and experiences, data collection and comparative analyses. At this meeting, the Pathophysiology Laboratory of the Shanghai First Medical College was delegated by the Microcirculation Study Committee of the Chinese Pathophysiological Society of the Chinese Association of Physiological Sciences to propose a plan for standardizing the methodology for human microcirculation study. After much discussion, a comprehensive plan will be put together after the meeting to integrate instrument/equipment, guidelines, and protocols (for clinical trials) to be used as references (see Appendix for plan) for clinical studies of the human microcirculation,

IV. Studies of Organ Microcirculation

In recent years China has done considerable research in studying the microcirculation of body organs. Not only has this contributed to the basic theory of microcirculation, it has also advanced the understanding on how the microcirculation relates to organic function and how it changes under pathological conditions.

Researchers from the Institute of Military Medicine of the Chinese People's Liberation Army reported on the results of their work studying the organ microcirculation in animals. They felt that the organ microcirculation displays specific and individual characteristics, as well as common characteristics, in the microcirculation in general. At this institute, ^{99m}Tc -tagged red cells were used in the body to determine the vascular volume of 13 organs in mice, and used ^{99m}Tc -tagged macroaggregates of albumin to measure the approximate blood flow volume in 15 rat organs. Their results showed that any organ which required the microvascular system to participate directly in its specific function and complete it, will have a larger vascular volume, making up 36 percent of the organ's weight. Examples are the lung, spleen, bone marrow etc. Should the microvascular system not participate directly in the organ's specific function, then the vascular volume in this type of organ will be smaller, about 2 percent of the organ's weight. On the basis of observations on the organ circulation in 23 body parts in man and animal, they classified the organ microcirculation structurally into six types: pinching (skin, lip mucosa), branching (conjunctiva, mesentery etc.), pouchlike net (enteric villi, thyroid gland follicle etc.), globoid filamentous (kidney glomeruli, splenic corpuscles etc.), densely reticular (liver, lungs etc.), and coral-like (red bone marrow etc.). On the basis of blood supply function, the microcirculation was classified as ischemia prone (enteric villi, kidney glomeruli etc.) and non-ischemia prone (gastric mucosa, lung etc.).

Use of Evan's blue to measure the microvascular permeability in rat organs showed that the vascular permeability was greatest in microvessels in the bone marrow ($20.33 \pm 0.82 \mu\text{g}/\text{mg}$ tissue), and lowest in those of the cerebellum and cerebrum (0.73 ± 0.60 and $0.49 \pm 0.07 \mu\text{g}/\text{mg}$ tissue), respectively. The differences in vessel-wall permeability here are related to the structure of particular organ microvessels. In the study of organ microvascular dynamics, *in vivo* observa-

tions of the microcirculation in ten animal organs and tissues such as bone marrow, lymph nodes, spleen, small intestine, brain, liver, kidney, pancreas, ear lobe, and mesentery showed that on the basis of the blood flow state, organs could generally be described as organs with rapid blood flow, the microcirculation dynamics changing very little (e.g., the brain); organs with rapid blood flow, the microcirculation dynamics changing more easily (e.g., malpighian splenic corpuscles, enteric villi etc.,); organs with slower blood flow and little microvascular breakdown (e.g., the liver); and organs with a slower blood flow and greater microvascular breakdown (e.g., bone marrow). Besides these, in organs such as the kidneys, pancreas, ear lobes, the mesentery etc., where the blood flow varies, because of variation in the location of their respective microvascular structures, pathological changes will be more readily noticed in their capillaries and postcapillary venules.

Researchers from the Pathophysiology Laboratory of the Shanghai First Medical College reported on a technique used for observing the surface microcirculation in the kidney of the domestic rabbit. Using *in vivo* observations and fluoroscopy, they studied the similarities and differences between microcirculatory changes in the bulbar conjunctiva and that on the kidney surface in domestic rabbits in hemorrhagic shock and in endotoxic shock. During hemorrhagic shock, marked microvessel contraction appeared in the kidney microcirculation, followed by noticeable abnormality in the flow dynamics, but manifestations opposite to these were noted in the microcirculation of the bulbar conjunctiva. During endotoxic shock, microvessel contraction appeared earlier in the kidney. Before death, widespread stasis was noted in the kidney microcirculation, but blood loss was noted instead in the bulbar conjunctiva. Comparison of these two types of shock shows noticeable microvascular contraction in hemorrhagic shock, but more noticeable microvascular dilation and stasis in endotoxic shock. Before death, the kidney microcirculation in hemorrhagic shock was in a blood loss state, but that in endotoxic shock was in a widespread state of stasis. The research results show that under the same type of shock, changes in the microcirculations of the kidney and the bulbar conjunctiva are not consistent, and microcirculation changes for the same organ under two different types of shock are not completely identical, but the consequences all lead to a decrease in tissue perfusion.

The Physiology Teaching and Research Laboratory of the Shanghai Second Medical College has established a simple technique for direct *in situ* observation of the cardiac microcirculation in mice. This consisted of observing the diameter of the surface myocardial microvessels and microvascular blood velocity before and after intraabdominal infusion of Salvia multiorrhiza. The results found that the salvia infusion exerted a pronounced effect on the myocardial surface vessels by markedly increasing the flow velocity and by dilating the microvessel diameters slightly, though the differences before and after drug administration were not marked.

The Pathophysiology Laboratory of the Second College of Military Surgeons, Chinese People's Liberation Army, reported on an *in vivo* method for observing the microcirculation in domestic rabbits. Through a window in the rabbit's chest, the researchers were able to observe directly, via microscope, changes in microcirculation dynamics of the lung after burn injury and intravenous injection of oleic acid. The results show that burn trauma and oleic acid can evoke short-term temporary contraction of the pulmonary blood vessels which later gives way to congestion and stasis, and edema in the interstitial spaces or the pulmonary alveoli.

The Experimental Institute of Industrial Hygiene of the Chinese Preventive Medicine Center revealed results of scanning microscopic observations of bone marrow tissue in normal rats and that in rats after exposure to a 625-rad dose of whole-body ^{60}Co -gamma radiation. They discovered that a postradiation breakdown in blood sinuses and a reduction of blood-forming cells are consistent, in both time and intensity. With an increase in blood-sinus breakdown and blood-forming cell reduction, there is a corresponding increase in the numbers of reticular cells and fatty cells. When the blood-forming function begins to reappear, a corresponding decrease in reticular and fat cells also occurs, gradually replaced by normal marrow tissue. The experiment results prove again the importance of an appropriate blood-forming microcirculation environment in maintaining normal blood-forming function.

Workers from the Nanjing Institute of Pharmaceuticals described their research using radioactive microspheres to locally determine the blood flow volume of individual organs. The methodology details and the experimental use of biologic microspheres in China at present were discussed at length by the attendees. Also reported by researchers from this institute was the use of radioactive microspheres to study the effect of gossypol on the testicular blood flow volume and testicular function in white rats.

Laboratory workers from the First Hospital Center of the Hubei Medical College and researchers from the Pathophysiology Laboratory of the Shanghai First Medical College reported separately on using the cranial window method to observe the microcirculation in the brain of domestic rabbits, and direct observation, through the skull, of the surface microcirculation in the meninges of mice without trephining a window in the skull. Because the latter technique is non-invasive to the skull, its protocol is simple, and visibility is good, it has become a simple and manageable technique used clinically and in the laboratory for studying the cerebral microcirculation and for screening drugs.

At the Pathophysiology Laboratory of the Zhanjiang Medical College, researchers are using *in vivo* direct observation techniques to study the liver microcirculation of white mice for their reaction to biological and physico-chemical factors capable of causing disease, such as bacteria, ammonia salts, asphyxia, high temperature etc. Results show that three types of microcirculatory changes take place in the liver--in the central vein of acinar cells, in the terminal branches of the inter-lobal veins, and in the liver sinuses. (1) The microvessels in all three of these liver components dilate, accompanied by a slowdown in blood flow to the point of stasis, chiefly among those groups with *Staphylococcus aureus* present. (2) Blood flow in all three microvessel types is slowed down, as diameters of the central veins and terminal branches of the inter-lobal veins contract, chiefly in groups where *B. coli*, ammonium carbonate, and asphyxia are present. (3) Contraction and increased blood flow occur sooner or later in these three types of microvessels, followed by dilation and diminished blood flow, seen in the group with burn injuries. The reaction toward these various factors show changes in the diameter of the central veins are most sensitive, whereas changes in blood flow velocity are the chief manifestations found in the terminal branches of the inter-lobal veins and the liver sinuses. Such changes may be due to the way the structure and function characteristics of different microvessels in the liver relate to the nature and intensity of these disease-causing factors.

The report from the Guangzhou School for Military Surgeons, the Chinese People's Liberation Army, described use of the abdominal window technique on rabbits and

dogs to observe changes in the microcirculation hemodynamics and blood flow conditions in the small intestine's serous coat during acute changes in total body function. During the experiment, sodium nitroprusside was given intravenously to quickly lower the blood pressure, and arterial bloodletting and intravenous noradrenalin were administered to provoke shock and near death states. Following a blood pressure drop, changes in the microcirculation of the intestinal wall showed an orderly pattern: when the blood pressure was maintained above 60 mm Hg, the flow velocity and flow conditions of the intestinal microcirculation were maintained at normal levels; when the blood pressure dropped below 60 mm Hg, the microcirculation's flow velocity was slowed, red blood cells clumped together, and diameters of the microvessels became constricted; and when the blood pressure dropped below 30 mm Hg, the supply of blood oxygen to intestinal tissue cells ceased. Besides this experiment, meaningful explorations studying the microcirculation of the tongue and the stomach were done by other research units.

At any rate, China's research efforts in studying the microcirculation of various organs have yielded results. The outstanding highlights are the number of organs studied, the new methodologies used, the good coordination of microcirculation morphology, flow dynamics, flow volume, and organ function in these studies. Future efforts should continue to concentrate on these studies in depth and further strengthen their clinical aspects.

V. Microcirculation and Hemorheology

The field of hemorheology chiefly studies the characteristics of blood flow and its rheologic behavior, and explores their evolving patterns in the course of human development, in terms of physiology and etiology. It is a new science that has evolved over the last 20 years. In recent years it has aroused the great interest of scientists in the fields of medicine and biomechanics, and some work has been started in this field.

A close relationship exists between hemorheology and microcirculation research. At the meeting, researchers from the Institute of Hematology of the Chinese Academy of Medical Sciences described the relationship between hemorheology and the microcirculation. It was pointed out that the completion of normal microcirculatory physiological function is dependent on a normal blood flow state in the microvessels, and the extent of microcirculatory obstruction is frequently found markedly consistent with the severity of flow state changes in the blood-stream. If the flow dynamics in the microvessels and the relationship between the vascular walls and the blood cell flow are not understood, then an overall understanding of the microcirculation is not possible. The relationship between hemorheology and the blood's oxygen transport function was also described.

Researchers from the Institute of Mechanics of the Chinese Academy of Sciences described some basic concepts pertaining to hemorheology, and gave an introduction to a general understanding of the subject.

Workers from the 304th Hospital of the Chinese People's Liberation Army reported on their observations of blood viscosity indexes gleaned from their research on burns. They noticed an increase in blood platelet aggregability in dogs 2 hours after burn injury, and marked changes in blood viscosity, red cell aggregation and antithromplastin III. Their work suggests if blood viscosity in a burn patient is not restored over a long period of time, it may indicate a poor prognosis.

Workers from the Xuzhou Regional Hospital reported on their observations of the hemorheologic changes in patients suffering from epidemic hemorrhagic fever and acute myocardial infarction. They described how the blood viscosity in myocardial infarction patients increased while the bulbo-conjunctival microcirculation slowed to increasing stasis, which they felt indicated a close relationship between the incidence of acute myocardial infarction and increasing blood viscosity. Whether or not the blood viscosity increases, may be used as a differential indicator for prevention and treatment of acute myocardial infarction.

Researchers from the Institute of Hematology of the Chinese Academy of Medical Sciences also determined the rheologic nature of red cells in cerebral thrombosis patients, and found this characteristic occurring much less frequently in sick individuals than in healthy persons.

At the First Workers' Hospital, Department of Headquarters Base Operations of the Chinese People's Liberation Army, researchers made joint observations of the peripheral microcirculation and hemodynamic indicators. They noted the importance of blood viscosity in cerebro-cardiovascular diseases, particularly in acute cerebro-cardiovascular ischemia. They feel that joint observations of the hemodynamic indicators and the peripheral circulation can supplement each other to further evaluate the causes and extent of microcirculatory obstruction, and are of definite clinical value in predicting and preventing acute and chronic ischemic diseases of the central and peripheral vascular systems.

Hemorheologic research in China has only begun. Related information on it needs dissemination, and measurement techniques and protocols need further upgrading. If the courses of certain diseases and basic pathologic conditions (e.g., shock, cell proliferation etc.,) are studied from the perspective of the microcirculation and its hemorheology, the new knowledge and the new preventive and treatment measures that will ensue will also be beneficial for further work in basic research.

VI. The Application of New Techniques and Methodologies in Microcirculation Research

Beginning in the 1970's, closed-circuit television has been used in China for microcirculation research. This was followed by successful design of instruments and equipment employing video microscopy with the dual-slit method to measure velocity and the vessel diameter of microvessels at rest and in action. Because of participation of scientific researchers from the biomedical engineering and biophysics fields in recent years, new techniques have been introduced into microcirculation research to bring it up to new levels.

Joint efforts by researchers at Qinghua University and the Institute of Pediatrics of the Chinese Academy of Medical Sciences have produced an integrated flowmeter for measuring microcirculation parameters. Based on the velocity measurement system of the double window method, this instrument used the principle of the self-tracing window and line-by-line sampling to determine microvessel flow velocity, to measure flow velocities of two branch vessels at the same time. While this method assures the accuracy of the lower limit measurements, it also assures the upper limits of a higher flow velocity measured, so that slight changes in the measured sample would not affect results. Because simple correlation is used, related calculations are greatly simplified. The video window assessment method is used with the same instrument to determine the red cell ratio volume in the

microvessels, and the light-grid square-root calculation method is used during the flow state to measure the diameter size of the microvessel in action.

The laser-Doppler method has been used at Nankai University in Tianjin to measure the flow velocity in single microvessels. During the last two years, researchers there have used light-excitation mixed-frequency techniques and the Doppler principle to design an LDB-1 model laser flowmeter that has been tested by the Institute of Hematology of the Chinese Academy of Medical Sciences in experimental trials. It was found to be non-invasive, was able to continuously monitor the red cell perfusion volume in the microcirculation of the skin and tissue surfaces, was easy to use, and was well suited for clinical and laboratory use.

The Shanghai Institute of Laser Techniques and the Second Military Medical College of the Chinese People's Liberation Army collaborated in the successful design of a laser-Doppler microscope by applying the microscopic structure to the light circuitry of the laser flowmeter. Its use in subsequent animal experiments has proved that it has a high spatial discrimination threshold, such that areas explored can be as small as a few microns in diameter. It is also highly sensitive to dynamic reactions, and the results are accurate and easy to analyze. It is a comparatively ideal instrument for measuring microvessel blood flow.

Researchers from the Pathophysiology Teaching and Research Laboratory of the Shanghai First Medical College introduced a fluorescence imaging technique for observing microvessels. By showing how the fluorescein seeps out of the blood vessels and noting how the red cell axial flow and boundary flow change, this technique becomes an effective tool for microcirculation research. It also supplements the ordinary microscope used for this purpose.

Researchers from the Tongren Hospital in Beijing reported on the double-window method of real-time rate determination used to measure changing patterns in the nail fold microcirculation of 72 normal individuals and 39 patients with liver cirrhosis. Their efforts yielded some significant findings. Researchers from the Pathophysiology Laboratory of the Institute of Basic Medical Sciences, the Chinese Academy of Medical Sciences and the Microcirculation Laboratory of Tongren Hospital also compared their findings from use of two methods--the double-window method of real-time rate determination and direct visual observation--in their studies of different flow conditions in the same experimental animals. According to Tian Niu, semi-quantitative methods by direct visual observation may classify flow states in microvessels as linear flow, linear-granular flow, granular flow, and granular slow flow. The results show that marked differences are seen in the statistical treatment of diameter sizes at different flow velocities in different flow states, but no differences are seen in measured values in the same flow state. This explains that the semi-quantitative method of direct visual measurement is practical and simple to promote for wide use. Various research groups can choose methods suited for their situations. These new techniques and instruments all provide important reference parameters for studying microcirculation dynamics.

In their discussions, attendees to the conference also indicated that few methodologies exist at present for determining microvessel pressure, and substance transfer and exchange in the microcirculation. While recognizing the fact that research on new techniques and methodologies require the design and production of high-quality precision instruments and equipment, they felt attention must also be paid to the design of inexpensive and simple-to-use instruments and equipment for quantitative microcirculation studies suited for clinical use.

VII. Problem of Standardizing the Nomenclature and Terminology Used in Microcirculation Research

Certain microcirculation-related terms as found in the medical literature today are not standardized and used with any degree of consistency, so that meanings are often unclear and even downright unscientific sometimes. This situation is unfavorable for furthering microcirculation research in depth and for exchange of experiences. For this reason, before this meeting was held, the Microcirculation Study Committee of the Chinese Pathophysiological Society of the Chinese Association Association of Physiological Sciences had appointed several colleagues, primarily from the Institute of Pediatrics and the Institute of Hematology (both of the Chinese Academy of Medical Sciences), to draft a list of commonly used microcirculation terms for discussion at the meeting.

It was agreed by all that usage of microcirculation terminology in the past was not consistent and must be standardized. During the course of standardization, attention must be paid to the scientific and logical nature of such terms, as well as their habitual use. Where use is unscientific, it must be corrected. Where ideas are illogical and unclear, changes must also be made. During this process, habitual use of such terms, on the basis of their scientific and logical nature, must also be considered. This is a very important task, which is also a difficult and detailed one requiring time for repeated reflection, reasoning, and thought. For this reason, no formal proposal was made at the meeting. Instead, the original drafters were asked to make revisions in accordance with suggestions made at this meeting. After a broad base of opinion had been sought, the revised draft will be recommended for trial.

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LIFE SCIENCES

BRIEFS

SHANGHAI PHYSIOLOGICAL EXPERIMENT--Shanghai, 21 Jan (XINHUA)--The Shanghai Physiological Research Institute of the Chinese Academy of Sciences conducted an experiment to test human body functions under the oxygen-deficient condition at high altitude. The experiment used a 9-meter-long and 3-meter-wide low-pressure chamber simulating the environment at an altitude of 3,600 meters above sea level--equivalent to that of Lhasa. Eight young scientists and technicians took part in the experiment. They lived in the chamber for 14 successive days, from 5-21 January. [dates as received] The experiment produced a series of valuable data, including data showing the functioning of the brain, lungs, heart and blood vessels under such conditions. [Beijing XINHUA Domestic Service in Chinese 1447 GMT 21 Jan 85 OW]

PLA TUMOR CENTER--A PLA tumor center has basically been completed at the Bayi Hospital under the Nanjing Military Region. The center began operation in 1981 while it was still under construction. Since then, it has treated some 2,100 patients and performed some 1,200 surgical operations. [Beijing Domestic Service in Mandarin 0900 GMT 14 Jan 85 OW]

MEETING ON PHARMACEUTICAL LAW--The Fujian Provincial Public Health Department recently held a forum on pharmaceutical work to prepare for the enforcement of the PRC Law on the Control of Medicines, which will go into effect on 1 July this year. At the forum the participants discussed the guidelines of the national conference on pharmaceutical work and studied measures for enforcing the new law. The provincial public health department will issue licenses to manufacturers and dealers of medicines and chemical reagents during the first half of this year. Licenses will be issued to units that are certified by public health departments. Licenses for dealers of medicines and chemical reagents will be issued by the prefectoral and city public health departments. Units that have not obtained licenses by 31 December 1985 will be banned from manufacturing and dealing in medicines and chemical reagents. [Text] [Fuzhou FUJIAN Provincial Service in Mandarin 1130 GMT 25 Jan 85]

FIRST ACUPUNCTURE HOSPITAL--Hefei, February 5 (XINHUA)--The first hospital in China devoted exclusively to acupuncture opened in Hefei, capital of Anhui Province on Monday. The hospital, attached to the Anhui Institute of Traditional Chinese Medicine, will also engage in research and training of doctors. It is equipped with the latest scientific equipment. Acupuncture made great strides since the founding of new China in 1949. Now many hospitals have acupuncture departments. [Text] [Beijing XINHUA in English 1211 GMT 5 Feb 85 OW]

NANNING LYSINE PLANT--Nanning, January 30 (XINHUA)--Work has begun on the construction of one of China's largest lysine plants in Nanning, capital of the Guangxi Zhuang Autonomous Region. A key project in the Sixth 5-Year Plan (1981-1985), the plant, with an annual production capacity of 1,000 tons of lysine (an amino acid), is expected to go into production next year. It is being built jointly by the Ministry of Agriculture, Animal Husbandry and Fisheries, and the Guangxi Regional Government with an investment of 23 million yuan. Guangxi's rich sugar cane and cassava resources provide abundant raw materials for lysine production. At present Guangxi produces a total of 670 tons of lysine a year. [Text] [Beijing XINHUA in English 0645 GMT 30 Jan 85 OW]

GENETICALLY PRODUCED INTERFERON TESTING--Beijing, 13 Feb (XINHUA)--Human alpha interferon produced by the intestinal bacterium e.coli is to be clinically tested in China, according to an appraisal meeting here yesterday. Experts said this was the first time Chinese scientists had biologically engineered an antiviral drug. It will be used to treat some viral diseases and malignant tumors. Work on interferon production in China was begun in 1979 by a group of scientists under professor Hou Yunde of the National Center for Preventive Medicine's Virology Institute and associate professor Liu Xinyuan of the Chinese Academy of Sciences' Shanghai Biochemistry Institute. Professor Hou said the first natural white cell interferon of clinical grade in China was produced in 1981, and the interferon gene was cloned from a white cell in 1982. In 1983 the interferon gene was expressed in e.coli at a high level, and in 1984 interferon was purified to clinically usable homogeneity. The human alpha interferon in e.coli seems to have the same physiochemical and biological characteristics as naturally produced interferon. [Text] [Beijing XINHUA in English 1258 GMT 13 Feb 85 OW]

SHENZHEN MEDICAL DEVELOPMENT CENTER--Beijing, January 29 (XINHUA)--A development center for medical science will be set up in Shenzhen, Guangdong Province, the paper, "HEALTH NEWS" reported today. The center, for which 30 million yuan will be collected, will facilitate the collection, exchange and study of information on medical science in China and other countries. It will also provide market information on medical supplies, and offer facilities for international symposiums. The center will also organize exhibitions of medical instruments and equipment. Technical consultancy will be available. The center will help promote popularization of advances in medical science. [Text] [Beijing XINHUA in English 1211 GMT 29 Jan 85 OW]

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ENVIRONMENTAL QUALITY

ENVIRONMENTAL S&T POLICY DISCUSSED

Beijing HUANJING BAOHU /ENVIRONMENTAL PROTECTION/ in Chinese No 9 /Sep/ 84
pp 7-9, 19

/Article by Liu Zhenyuan /0491 2182 3293/: "The New Technical Revolution and the Present Environmental S&T Policy"

/Text/ The new technical revolution is now being closely followed, observed and studied in China and abroad. Our scientists and technicians in environmental protection must also constantly keep track of the new trends of the new technical revolution in the world, combine China's actual conditions and put forward countermeasures to promote the coordinated economic-environmental-social development in China.

Someone did an analysis and found that one-fifth of the work of completing scientific and research plans in developed countries depends on funds and equipment and four-fifths of it depends on scientific organization and management. This shows how important management is. In recent years, China has begun to improve and reform a series of work in topic-selection in environmental science and research, long-term program, planning, examination of achievements, popularization and application. In order to suit the new situation since the Second National Environmental Protection Conference and to consider the future impact of the new technical revolution on the environment, I believe that the following must be stressed in formulating the present environmental S&T policy.

1. Stress technical research in pollution control and technical transformation of traditional industry at the same time.

Environmental pollution in China is quite serious. In 1983 the amount of waste water discharged was more than 31 billion metric tons, waste residue 430 million metric tons, and the industrial "three wastes" polluted more than 40 million mu of cultivated land. On the other hand, due to the damage to forests and grassland, an area of 1.2 million square km has been affected by soil erosion and more than 5 billion metric tons of soil is eroded annually, the nitrogen, potassium and phosphorus content of which is equivalent to China's total annual output of fertilizer.

Faced with these problems, we must stress research on the techniques of pollution control. As much as possible, we should adopt the most advanced techniques

that suit our national conditions, actively develop biochemical and physio-chemical methods to enrich, concentrate, adsorb and remove nitrogen, phosphorus and potassium from polluted water, prevent eutrophication and control the environment from being polluted. As for processing techniques of low-concentration sulphur dioxide, we must transform it into productive forces as soon as possible. For a time in the first half of the 1970's, China had concentrated its efforts on decontamination treatment. Due to the limitations of many contamination techniques, particularly the decontamination installations being often high in investment, energy consumption and cost of operation, decontamination installations cannot give play to all their benefits. For example, during 1974-1978 the Huasheng Paper Mill in Suzhou invested 510,000 yuan on building a set of decontamination installations that could treat 160,000 cubic meters of waste water daily had an annual operating cost of 72,300 yuan. Consequently, it is highly necessary to study decontamination facilities and technology that are high in efficiency and results but low in investment and energy consumption.

Industrial pollution is a principal cause of environmental pollution in China. For a long time, China has mainly relied on extensive expanded reproduction and has not stressed intensive expanded reproduction. As a result the majority of enterprises have old equipment and use outdated technology. They are slow in the process of improvement and upgrading, seriously wasteful of energy, poor in economic results and pollute the environment. Someone has estimated that during the last 10 years the number of scientific and technological inventions and innovations in the world has exceeded the sum total of those in the past 2,000 years, and that 30 percent of the technology, equipment and other measures have been eliminated. By comparison, the innovation and transformation of technology and equipment in China demand acceleration. For example, China's 12,000-kilowatt medium- and low-pressure generating units are outdated and cause serious pollution. The quantity of power generated constitutes 25.7 percent of hydropower in the country as a whole and the consumption of coal is 45.2 percent of the total. If we replace them with 200,000-kilowatt generating units, we can save about 14 million metric tons of coal annually. The funds for updated equipment can be regained from the coal economized. Technical transformation is a basic way to control industrial pollution.

In foreign countries, thus far traditional industry is still the mainstay of the Western economy. At present, they are using new technology to transform traditional industry, fully increasing the utilization rate of resources and energy, utilizing the combination of electronics technology and engineering technology and using industrial robots in production thereby some hazardous and toxic pollutants and be treated. Nonharmful and nonwaste technology is flourishing in some countries.

Traditional engineer, metallurgical and textile industry roughly account for 80 percent of China's output. Building more of these enterprises can only worsen environmental pollution in China and the situation forces us to adopt new technology to vigorously transform traditional industry. We should develop knowledge- and technology-intensive industry.

2. Stress development of new technology and application of new technology at the same time.

In recent years, a series of new and developing science and technology have emerged such as microelectronic technology, biological engineering, laser technology and optical fiber technology. Judging from the overall trend of development, the development of these most advanced technologies is favorable to solving environmental problems. In the chemical industry, biological engineering can be used to transform high-temperature and high-pressure technology into ordinary-pressure biological methods for processing. This can economize on a great amount of energy. According to estimates by American specialists, 25 percent of existing organic chemicals can be produced by biological engineering. For example, using enzymes to produce fatty acid can reduce 98 percent of the fuel used by existing methods. Agriculture is an important area of application of biological engineering. Foreign countries are studying the use of cytomixis techniques to transfer nodule bacteria from bean plants to rice, wheat and maize so that they may have azoto ability. This can economize on chemical fertilizer and avoid the pollution of water bodies due to surface runoff.

The prospects of new energy utilization is broad. Solar energy, bioenergy, geothermal energy, wind energy, ocean energy are all natural, can be regenerated, are inexhaustible and do not pollute the environment. American scientists have successfully extracted "gasoline" from the sap of certain vine and shrub which does not produce carbon monoxide and other harmful elements during combustion. It is expected that biological engineering and other disciplines will cause a major industrial revolution at the end of this century. This revolution will promote a rational solution to energy and environmental problems.

We must actively support the development of new technology and research on some basic environmental sciences, but we must avoid the shortcomings of acting like a swarm of bees and a gust of wind in the past. We must combine China's actual conditions and proceed with emphasis and planning and in steps. At the same time, when we stress developing new techniques we must also stress their popularization and application, promote the development of techniques for pollution control, give impetus to the technical transformation of traditional industry, solve China's environmental pollution problems and promote China's economic development.

Proceeding from China's present realities, we must pay particular attention to the development of applied sciences, particularly some "suitable techniques" which suit our national conditions, require less investment and have quick results.

In order to solve China's environmental problems as soon as possible, we must tear down the barriers between trades and enterprises, organize the resources from various quarters, and promote the popularization and application of achievements in environmental science and technology and new technology. The starting point and end-result of our work in environmental S&T is to transform these achievements into productive forces as soon as possible.

In recent years various departments have imported considerable environmental installations. Which installations suit our national conditions, which can be manufactured and popularized in China and which can be further improved? to avoid rash and duplicated importation, it is highly necessary to conduct an investigative study of installations imported.

We must actively study the application of microelectronic computers in environmental protection work, and with such application as the breach, promote it at multiadministrative levels in various areas of environmental S&T, supervision, information, management and control, and advance wave upon wave.

3. Stress the hard scientific research as well as the study and application of soft science and technology.

The hardware in environmental science (hard science and technology) is the material basis of our changing the appearance of the environment and eliminating environmental pollution. Without advanced technology and equipment, without advanced control technology and if we do not carry out technological transformation, pollution will not be eliminated and China's environmental problems will not be solved in a basic way. In the future, hard science and technology will remain an emphasis in the scientific and technical work of environmental protection in China.

Hard science and technology and soft science and technology in environmental science must develop in coordination and advance in steps.

According to incomplete statistics, 25 to 30 percent of pollution on the environment is caused by bad management. Strengthening environmental management is urgent. We environmental scientists and technicians must strive to study new and modern scientific knowledge and management, and link this knowledge with ways to change the state of the environment in China.

The role of soft science cannot be overlooked. The Chinese Institute of Environmental Sciences and the Dongfanghong Oil Refinery have cooperated in applying the environmental supervision data produced by that refinery in 1981, using input-output--linear programming model to improve five different targets. For this project alone, under the prerequisite that the supply of crude oil remains unchanged, output value has an actual increase of 40 million yuan over 1981 with a growth rate of 3.4 percent. Although the quantity of waste water has increased, it is still below the treatment capacity of the waste water treatment plant. The cost of treatment has merely increased by 124,000 yuan. The discharge of waste water is consistent with state standards.

In taking preventive measures, foreign countries stress the study of assessment of environmental impacts and forecast study. We have also actively developed the work in this area.

Based on the characteristics of environmental science, completion of a major project in environmental science and technology often require close contacts among multiple disciplines and organs as well as their vigorous cooperation. However, many of our units are managed independently and are affected by the

mentality of large and complete and small and complete. They are generally inadequate in human, financial and material resources and cannot fully play their role. At present, we are confronting the serious challenge of a new technical revolution in the world and we must reform production relations and the superstructure that do not suit production development. For this reason, we must build "flexible organizations" and organize "dynamic management" by virtue of the strong comprehensiveness of environmental science and the nature of scientific and technical projects, that is, maintaining the stability of the scientific and research system which also facilitates development of the work and reducing the administrative structure. This will easily pool our strength for vigorous cooperation and overcoming key problems.

The modernization of science and technology cannot be divorced from the modernization of management. Without the modernization of management, the technical revolution will not be possible, and without new achievements of the technical revolution such as microelectronic technology and information technology, modernization of management too cannot be realized.

4. Stress modernization of management and information work in environmental science and technology at the same time.

In our management work in environmental science and technology, whether in formulating long-range plans for science and technology, starting topics or the appraisal, popularization and application of achievements, every link cannot be without accurate and reliable information. There are plenty of examples of duplication of work under low standards due to poor access to information. In formulating development plans of environmental science and technology and developing new technology, we must consider more of the long-term aspects, information must be accurate and reliable and we must advance in a safe pace. This is because it generally takes 12 to 15 years to overcome basic economic and technical problems from basic research until transformation into productive forces. Moreover, in economic construction, we must have coordinated economic-environmental-social development, and organizing to overcome scientific and technical problems also requires information. What particularly deserves attention is that in the course of planning and implementation, we still need to have continuous information feedback and to correct our course.

The issue of entering an information society from an industrial society is being discussed around the world. An information society is one with an intelligence-intensive structure. Information has become an important resource in social production; the production, storage, processing, transmission and handling of information will become a key industry. The characteristics of an information society is high efficiency, great results, rapid growth; low pollution, low energy consumption and low consumption. Proceeding from long-range goals, we must build a modern information system that is highly efficient, accurate and suitable in order to realize modernization of management.

In the age of the scientific and technical revolution we must do a good job in scientific and technical work. We must not only understand scientific and technical professions but more importantly we must realize scientific decision-making. Those that do not go through investigation of objective affairs,

accurate information and policy studies are not scientific and lack the necessary practical basis. At present, it is highly necessary to fully utilize such forms of organization as environmental scientific and technical information network, organize and coordinate the strength of environmental science and technology throughout the country and link up information channels in order to provide strategic and tactical information for decisionmaking at the leadership level and overcoming scientific and technical problems.

In the world as a whole, manual processing in information work can no longer satisfy the needs of the development of S&T. Information work has already entered the new age of the three combination of "information, computers and modern communications technology. In taking the first step, China should centralize planning and measures in its environmental system and advance in this direction.

In short, the principle of our environmental S&T policy for the new technical revolution is: base ourselves upon the present and look forward to the future, have long-range goals and a steadfast spirit.

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ENVIRONMENTAL QUALITY

CHINA'S S&T POLICY IN ENVIRONMENTAL PROTECTION DISCUSSED

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[Text] The environment and natural resources are the main conditions which mankind depends on for its existence and are the sources of material for the development of production and the promotion of economic prosperity. Good management of China's environment and rational exploitation and utilization of natural resources are a basic task of modern construction.

The resolution of environmental problems requires manpower, material resources, science and technology, joint efforts on the part of all trades and professions and the concern and care of every member of society. However, the most important requisite is for the state to formulate proper environmental protection principles and policies and to adopt timely and effective measures. The components of environmental protection policy are multifaceted, including management policy, economic policy, education policy, scientific and technical policy and so forth. A scientific and technical environmental policy is extremely important in resolving environmental problems because the state must use this to organize scientific and technical routes and technical economic policies to resolve environmental problems. This article attempts to conduct a discussion of this important question of China's scientific and technical policy on environmental protection and to suggest some views and ideas.

I. Basic Conditions for the Development of China's Environment Science Research

China's scientific and technical policy on environmental protection is progressively clarified and constantly improved on the basis of environmental principles and policies. Summarizing the 10-plus years of China's struggle in this area, we believe that the basic factors in her environmental science research are as follows:

A. We Must Have a Proper Objective for Resolving Environmental Issues. Our understanding of this question has been progressive. At the beginning of

the 1970s many provinces, cities, autonomous regions and industrial and mining enterprises in China began to establish offices to be individually responsible for controlling the "three wastes." They mistakenly believed that once the "three wastes" were controlled, environmental problems would be resolved. At that time environmental objectives were partial and microenvironmental: the single technology, the workshop, the single factory. Many years of struggle have made it clear that merely stressing control of the "three wastes" cannot completely resolve the problem. That is to say, we should enlarge our environmental objectives. Consequently, beginning in the mid-1970's we started to emphasize the regional environment and to take charge of comprehensive regional prevention and control work, with quite distinct results. By the end of the 1970's and the beginning of the 1980's people further understood that the scale of ecological and environmental destruction brought about by improper agricultural production activities is also very extensive and that we must view the country as a whole, consider problems in terms of nature's overall ecological balance and satisfactorily protect all of our territorial natural resources and our ecological environment. Our scientific environmental research objectives were made more explicit and a scientific and technical environmental policy was advanced to achieve these strategic objectives.

B. We Must Have a Major Orientation for Environmental Science Research. Because of our different understandings of environmental objectives, our major orientations in environmental science research have also differed. The major orientation of scientific research at the beginning of the 1970's was toward individual control techniques, such as boiler remodeling. In the mid-1970's the orientation was toward comprehensive prevention and control techniques and the evaluation of environmental quality. In the 1980's we are embarking upon a period of joint efforts at cooperation between workers in natural science and social science to seek a fundamental resolution of environmental problems. This time we are stressing a consideration of problems from the perspectives of rational use and protection of natural resources, ecological balance and the environment as a whole.

C. We Must Have a Certain Number of Specialized Environmental Science Research Organizations. For more than 10 years now, particularly in the most recent few years, China has been in the process of forming a certain number of environmental science research organizations, each with its own emphasis. These can be divided generally into four major systems: 1) The Chinese Academy of Sciences: As early as the 1950's the Chinese Academy of Sciences had established the National Commission for Comprehensive Investigation of Natural Resources, as well as research organizations concerned with water and soil conservation, forestry and soil science, to lay a foundation to investigate and study China's natural resources and protect the natural environment. At the beginning of 1975 the academy also founded the Institute of Environmental Chemistry specifically to suit the needs of Environmental science research work. In addition, there is also the combined practice of research offices and groups from 26 academy institutes, which stress research on the bases of environmental applications and new technology. In 1980 the Academy founded the Environmental Science

Commission specifically in response to the suggestions of the scientific community. 2) Institutions of Higher Learning: Beginning in the 1970's there were more than 30 institutions of higher learning that had established specialties in some branch of environmental science or that were engaged in some aspect of scientific research, and some of these set up institutes of environmental science research. Their work stressed basic theory and engineering, environmental education and the training of qualified personnel. 3) The Environmental Protection System: Since the 1970's the environmental protection system, extending from the central government down to the provinces, cities and autonomous regions, has everywhere established environmental protection research institutes and monitoring stations to resolve environmental problems in those areas. The vast majority of efforts in this system have been on environmental quality investigation and research, pollution prevention and control, and monitoring. At present there are more than 600 environmental monitoring stations (offices) above the county level. 4) The Ministry and Commission System: The ministries of Industry, Agriculture and Communications, as well as large enterprises, all have environmental protection research organizations. As early as the 1950's the Ministry of Health included a large amount of environmental monitoring work in its sanitation and antiepidemic station work departments of meteorology, water conservancy and geology also established their observation stations earlier than, and on an equivalent scale to, the environmental system. The Chang Jiang river system alone has 156 water quality monitoring stations. Some large enterprises have also established specialized research organizations to resolve the environmental problems of their particular industries.

D. We Must Have a Certain Quantity and Quality Scientific and Technical Contingent Engaged in Research on All Aspects of Environmental Problems. The Chinese Academy of Sciences has tentatively formed a multi-discipline, comprehensive environmental science research contingent. Nearly 1,000 scientific and technical personnel are engaged in environmental chemistry, biology, toxicology, pedology, physics and other aspects of scientific and technical research work. There are also several hundred people in institutions of higher learning who are engaged in environmental education and scientific research work. Since 1979 these institutions have all had student graduates with specialties in environmental science and these students have been distributed to work on every front. According to incomplete statistics, China already has an environmental science research contingent numbering approximately 5,000 people.

E. We Must Look Upon Environmental Science as a Burgeoning Discipline, and Foster and Develop It. The past 10 years of struggle in China make clear that in order to resolve environmental problems we must launch a large quantity of multifaceted scientific research work. Consequently, workers in pedology, chemistry, biology, physics, mathematics, engineering technology, economics, law, sociology and other disciplines, when applying the theories, methods, techniques and knowledge of their particular disciplines to solve certain problems in the environment, must all percolate this information down to environmental science. In this way, China's environmental science, which is a burgeoning, strongly comprehensive branch primarily of natural science--but which also encompasses certain branches of the social sciences--is

in the process of vigorous development. There are some workers in the natural and social sciences who are conducting theoretical research on independent subjects such as the definition, objects, categories, methodology, branch disciplines and so forth of environmental science. The state has adopted various measures to advance the development of environmental science. For example, it has established specialized research organizations, pledged certain personnel, equipment and funds and set up the Chinese Environmental Science Publishing House.

F. Work in Environmental Science Must Have Both a Long-Term, Long-Range Plan and a Short-Term Plan. Integration of the Two Preserves the Appropriate Proportions of Basic Research, Applied Research and Development Work. In 1977, at the National Planning Conference for the Natural Science Disciplines, the Chinese Academy of Sciences and scientists from institutions of higher learning jointly drafted China's first 10-year plan for development in environmental science. In 1978, the "National Scientific and Technical Development Plan for 1978-1985," which was directed and drawn up by the State Science Commission, contained a particular article on scientific and technical environmental development and made arrangements for basic research, applied research and development work. Therein it was proposed that "we tentatively establish within 8 years an all-inclusive environmental engineering research system for China and develop her environmental engineering." Every year the state sets aside a certain quantity of funds for aspects of scientific and technical environmental research.

G. We Must Popularize Scientific and Technical Environmental Knowledge. Environmental protection not only requires a large group of workers in environmental science, it also requires the vast ranks of the masses. We cannot truly achieve the objectives of environmental protection work until the masses master a knowledge of environmental science and everyone gets to work and shows his concern. At present many departments and units still lack both a knowledge of environmental science and an ecological viewpoint. This is one major reason why environmental protection work cannot develop smoothly. At the same time, explanation and dissemination of scientific and technical environmental knowledge is very important. The state has set up colleges and universities of environmental protection in Huangdao, Changsha and Nanjing, and has also founded multi-term cadre training schools. In 1979 it established the Chinese Institute of Environmental Science and this institute specially founded the Commission for Dissemination of Environmental Science and the Commission for Environmental Education. Different places also publish HUANJING GAOHU [ENVIRONMENTAL PROTECTION], HUANJING [ENVIRONMENT], DAZIRAN [NATURE] and other popular science magazines, developing science dissemination work.

II. Some Major Scientific and Technical Policies on Environmental Protection

Summing up the past several years of China's struggle, we believe that if we want to resolve satisfactorily our environmental problems, the following eight scientific and technical policies on environmental protection are extremely important:

A. Integrate National Land Management with Urban and Rural Construction, Develop Research on the Rational Distribution of Industry, Agriculture and Forestry. The task of national land management in China is to make a comprehensive survey of territorial resources, formulate a plan, and open up and use, control and protect our land in an overall way. One of the objectives is to ensure that China's forests, grasslands, cultivated lands, atmosphere, cities and villages are never again polluted or destroyed. In order to realize this objective, to bring about mutual cooperation between environmental protection and economic development and to build an environment that has a stable ecology, developed production and an attractive standard of living, the state is in the process of organizing a composite geological, economic, ecological, environmental science and natural resource research organization. They are also launching investigative research and proposing scientific and technical policies and organization measures that are suitable to our national conditions. China's irrational distribution of industry and agriculture and her construction of factories without regard to environmental conditions are one cause leading to environmental pollution. In the initial period after liberation, China's large and medium enterprises were basically centered in large and medium cities and the population was highly concentrated. This added to the assault on the urban environment and it simultaneously formed a pernicious concentration of the sources of pollution. Later we developed industry in the interior, constructed some large enterprises in mountain gorges and brought about both difficulties in diffusing the factory smoke and pollution of our water sources. In the past few years enterprise development in rural villages and towns has been very rapid, and this has brought about a diversion and dispersion of pollution and the destruction of the ecological environment. The importance of rational distribution has progressively been recognized by policymakers in all areas, and they have adopted vigorous measures. For example, Jinan City in Shandong implemented changes and corrections in production at seven chemical plants situated upwind and upriver from the urban district, achieving a basic resolution of the pollution danger from their chemical enterprises. We must proceed from a long-range, overall viewpoint, carry out analytical research on gains and losses and conduct a forecast and evaluation of environmental impact. Thereby we can formulate the optimum program for both environmental protection and production development. This is a crucial scientific and technical policy.

B. Control Industrial Pollution Through Technical Transformation, Replacing Equipment and Improving Technology. In China's existing industrial and mining enterprises only about 20 percent of the equipment is advanced, some 30 percent is ordinary and approximately half is already outmoded. Consumption of energy and raw materials is high, product quality is poor and pollution problems are rife. Consequently, implementation of technical transformation, equipment replacement and technological improvement in enterprises is the basic route to both increased production and improvement of the environment. For example, Shenyang Chemical Plant began to be concerned about environmental protection after the 1973 First National Conference on Environmental Protection. Through technical transformation, equipment replacement and technological improvement they have now achieved

notable success, and in 1981 they were named by the government of Liaoning as "the advanced environmental protection unit of Liaoning Province." Other examples include new techniques, which have already been popularized and applied in many enterprises, such as the non-cyanogen electroplating, non-effluent chromium plating and chromium mist inhibitors in the electroplating industry, and the enzymatic hair removal in the leather industry.

C. Emphasize Prevention and Study New Non-Polluting and Minimally Polluting Techniques and Technologies. On new construction, reconstruction and extension projects, and on remodeling projects to tap potential by adopting techniques and measures to increase production capacity, China stipulates that facilities for the prevention and control of pollution and other environmental hazards must, in addition to the principle part of new building projects, simultaneously provide for design, construction and operations ("the three simultaneous efforts"). This is a crucial policy for preventing the expansion of pollution and for controlling new sources of pollution. Just like the Department of Health's policy on disease treatment, it embodies prevention as its primary emphasis. At present the vast majority of enterprises have already enforced the regulation on the "three simultaneous efforts", however for both administrative reasons and scientific and technical reasons, a few enterprises have not yet been able to accomplish this. For this reason, we must launch research into new non-polluting or minimally polluting techniques and technologies and into innocuous disposal methods, and we must stress the replacement of toxic, and hazardous raw materials with raw materials that are low in toxicity and non-harmful. There is a certain investment every year at all levels of government to support the development of scientific research work in this area.

D. Encourage Research To Develop Natural Purification Capacities. There exist extensively in the natural world physical, chemical and biological functions that can dilute and disperse pollutants and reduce their concentrations below the limits at which they are harmful to mankind. They can also change the existing forms and chemical properties of pollutants and transform them from toxins into non-toxins. For example, at Yar Lake in Hubei, The Hydrobiology Institute of the Chinese Academy of Sciences achieved success using an oxidation-pool biopurification method to treat wastewater contaminated with organic agricultural chemicals. This consumes no electricity and requires no operating expenses, saving 7.06 million kilowatt-hours of electricity and 2.1 million yuan worth of operating expenses per year. It requires only a small maintenance cost on dams and dykes, and after purification the lake water can support fish and irrigation such that 500,000 jin of fish are harvested and grain production is increased by approximately 30 million jin annually. Precisely because this kind of varied, multi-channel purification capacity exists in nature, we should make full use of it. Considering China's overall national conditions, it is economically unrealistic for resolving environmental problems to rely completely on engineering measures that treat the three wastes. Therefore, we should make the full use of natural purification capacities a major component of our scientific and technical environmental

policy and bring about a mutual integration between this and treatment through engineering techniques to supplement each other and to yield twice the results with half the effort. There are some who propose a tripartite organic integration of "in-plant treatment, local treatment and river purification." We consider this an excellent suggestion that stands to save on investment and power consumption, and we feel it should be taken under consideration as a major state policy.

The study of the dilution and self-purification capacities of rivers is the research problem in water-source conservation work that now urgently needs to be resolved.

E. Intensify Research On Environmental Management in Order To Guarantee and Promote Control. Environmental management is an important branch of environmental science. It includes environmental policies, systems, monitoring, standards, evaluation, economics, law and so forth. Since the mid-1970's China has intensified scientific research work on this field, including, for example, research into the following areas: environmental management systems, the standardization of environmental analysis methods, the assessment of environmental quality and environmental forecasting, fundamental and various specific environmental laws and regulations (concerned with water, air, oceans, land, forests, mineral products and so forth), environmental economic benefits and so on. Based on a great quantity of scientific research work, in 1979 the "(Trial) Environmental Protection Law of the People's Republic of China" was promulgated. China's constitution also stipulated environmental protection clauses--something of major significance in the developmental history of China's environmental protection undertaking. Thereafter, the state successively promulgated specific laws and regulations concerning forests, oceans, bodies of water and other areas. In February 1982 the State Council issued a circular that provided for a system to levy pollution discharge fees on a national scale, and they also issued specific stipulations concerning the standards for levying pollution discharge fees, the sources of funding and the use of the discharge fees. In May 1982 the Ministry of Urban and Rural Construction and Environmental Protection of the PRC was formally established. At the beginning of 1984 the State Environmental Protection Commission, headed by Vice Premier Li Peng [2621 7720], was established.

The intensification of environmental management work has even more direct and practical significance for advancing the control of the three industrial wastes. After conducting an investigation of chemical, metallurgical, light industries and other seriously polluting industries, it has been discovered that some 50 percent or so of the pollution problems in many enterprises can be resolved through intensifying scientific management of the environment. The same is true of cities: scientific management played a major role in improving Shenyang's environment.

F. Multipurpose Use of Resources

In essence, industry's "three wastes" are the waste of energy and natural resources. Maximum multipurpose use of energy and resources is the basic

route to elimination of pollution and protection of the environment. Controlling the dangers of the "three wastes" in established enterprises must be solved in conjunction with multipurpose use of resources. In Das Kapital, Karl Marx said that "The chemical industry provides the most notable example of putting pollutants to use. When it discovers new methods of using waste materials it not only puts to use the waste materials of the particular industry concerned, it also puts to use the waste materials of all sorts of other industries. For example, coal tar, which had absolutely no use a few years ago, has been transformed into blue and red dyes and recently has even been turned into various pharmaceuticals." "This kind of economy has reduced production waste to an absolute minimum, and consequently all raw materials and supplementary materials that enter immediately into production have been used directly to the maximum degree." We believe that these words of Marx' represent precisely the basic view of multipurpose use of resources, and they are also a major component part of scientific and technical environmental policy. Mineral intergrowth and lean ores are quite common in China, and consequently implementation of multipurpose use of mineral resources can reduce waste and pollution and be of particularly crucial significance for environmental protection. The Baotou Iron Mine contains rare earth and, beginning in 1952, the Changchun Institute of Applied Chemistry of the Chinese Academy of sciences expended great efforts to develop research to isolate, analyze and use the extracted rare-earth elements. Quite a few of their positive results have already found direct applications in industrial production. In the past few years, through scientific testing and use of a flocculation mud-washing technique of ore dressing, they have been able to institute collection of 80 percent of the fluorine in Baotou steel, greatly alleviate pollution and put the resources to use. They have also conducted several years of research on the rare and precious metals in the Jinchuan Nickel Mine and on the vanadium and titanium in the Panzhihua Iron Mine. The government strongly encourages research into multipurpose use of resources and urges the multipurpose use of minerals, timber and petrochemicals. This is the state's priority scientific and technical project, for which it annually guarantees a certain outlay of funds and equipment. China has organized the prevention and treatment of industrial pollution on an extensive scale, focusing on multipurpose use of resources and transformation of the harmful into the beneficial as the major components of this policy, and they have achieved gratifying results. In 1980 the output value of the products of multipurpose use of resources was more than 800 million yuan. Every year more than 50,000 tons of nonferrous metals, precious metals and rare metals are recovered, and nonferrous smelters recover more than 800,000 tons of sulfuric acid produced from high-density sulfur dioxide. Taking the metallurgy industry as an example, if we make satisfactory multipurpose use of the large quantity of resources in associated metals, secondary energy, water used in industry, sulfur dioxide and metallurgical residue, we not only can reduce pollution, we can also provide even more vanadium, titanium, nickel, rare earth, niobium, platinum, palladium and other rare and precious metals, as well as other metals and nonmetals for the construction of China's four modernizations, thus accumulating funds for the four modernizations.

Taking the coal industry as a further example, one of the most serious environmental problems has become the energy waste and the pollution brought about by accumulating large quantities of gangue that remain after the coal extraction process. According to statistics, China has accumulated more than 1 billion tons of gangue. For quite a long period of time, China's energy structure has continued to stress coal. In the wake of further expansion in coal-using facilities, research into multipurpose use of gangue has become the major component part of China's scientific and technical environmental policy. Many mines have made a certain amount of headway in the multipurpose use of gangue. In the past 7 years, the Nanpiao Bureau of Mining, which has had rather notable results, altogether has used more than 3 million tons of gangue, produced an output value of more than 62 million yuan and reaped 17 million yuan of profit. Their method involves first the extraction of chemical products from the gangue, second the use of gangue as a fuel of low combustion value and third the use of gangue in the construction materials industry.

G. Comprehensive Treatment and Rational Use of Land Resources. The general state of land-resource use in China, with its large population and scarcity of land, is as follows: 10.4 percent of the total area is cultivated land; 37.2 percent is grassland; 17.9 percent is desert, wasteland or high mountain snowfield; 12.7 percent is forest; 4 percent is water and marshland; 6.9 percent is residential environment (cities, towns, industry and communications); and 10.9 percent of the area is otherwise occupied. In the area of land-resource use, from a nationwide perspective there are the following five common environmental problems: 1) population increase and expansion of cultivated land; 2) destruction of vegetation and water and soil erosion; 3) grassland degeneration and land desertification; 4) salinization secondary to land use; 5) utilization and protection of ocean resources.

The prevention and control of water and soil erosion and the protection and rational use of water and soil resources are basic measures for changing the appearances of mountains, hills and sand-blown areas; for controlling rivers and reducing disasters from water shortages, droughts and blowing sand; and for building a good ecological environment, developing production and improving lives. The CPC and the government pay close attention to water and soil conservation work and suggest policies for simultaneous development of prevention and control integrated with administration. The Chinese Academy of Sciences has intensified research on water and soil conservation and has established the Northwest Soil and Water Conservancy Institute. The State has revived the Commission for Conservation of the Middle Reaches of the Huang He. Approximately 290 provincial (district, county) water and soil conservation bureaus, water and soil conservation institutes, testing stations and other organizations have been revived or newly established. The "Regulations for Water and Soil Conservation Work" formulated by the State Council established coordination groups.

In order to prevent and control desertification, the Chinese Academy of Sciences specifically established the Desert Institute, conducted a great

deal of scientific research work and proposed a division into three prevention and control districts: 1) In the potential areas of desertification distributed over the semi-moist Youlingxing sand dunes we must comply with the special natural laws that exist, strictly and satisfactorily protect the ecosystem, bring the land utilization rate under control and take measures against possible trouble. 2) With respect to the areas of desert expansion in the semi-arid grasslands and desert steppes, we must satisfactorily protect the existing natural vegetation and confine the abandoned cultivated grass farms that produce desertification. In addition, we must establish a stable agricultural system that combines farming and forestry and has protection of the cropland and forest network as its mainstay. In addition, we must reduce the amount of livestock that is carried on grass farms and set up man-made bases for raising livestock. 3) In zones of desert encroachment and fixed and semi-fixed desert activation, we must keep rational use of water and soil resources in mind, plant more trees and grass to fix the wandering dunes and establish an oasis protective system.

In order to resolve the soil pollution problems brought about by agricultural pesticides and chemical fertilizers, we have decided to eliminate BHC and other organic chlorine pesticides, develop highly effective, low-toxicity, low-residue pesticides and adopt comprehensive technical policies to prevent and control plant diseases and insect pests. We have also decided to regulate the proportions of nitrogen, phosphorous and potassium in fertilizers, advocate the combination of nonorganic and organic fertilizers and put rational irrigation into practice.

H. Adopt Biological Measures, Plant Trees and Grass and Establish a Stable Man-Made Ecological System

Forests are a nation's major resource; some people have called them nature's chief control center. They have the ability to prevent and control atmospheric pollution and protect and beautify the environment, and they play a crucial role in improving the ecological environment.

China's current proportion of forest cover is 12.5 percent--a rate that is obviously too low. The state encourages scientific and technical workers, based on environmental protection requirements, to expand the afforested area by every possible means. Article 13 of the "(Trial) Environmental Protection Law of the People's Republic of China" explicitly stipulates the following: "strenuous efforts at afforestation and the planting of barren hills, wastelands, desert areas, semi-desert areas, villages, cities, towns and industrial and mining districts. We must make full use of all the scattered spaces--beside forests, roads, water, residences and so forth, both inside and outside of factories, mining districts, schools and organizations--to plant trees and grass and achieve a landscaping of the land." In March of 1980, the Central Committee of the CPC and the State Council specially promulgated the "Targets for Major Efforts To Launch Afforestation."

Planting the flatlands is the major policy for improving China's natural environment and agricultural ecology. In the past few years we have planted a 100 mu network of forest and cropland, put into effect intercropping of agricultural crops and paulownia on 1.5 million mu of cultivated area and planted 3.2 billion trees. Compatible with this, in order to strive for an early realization of the goal to landscape the land, the Ministry of Forestry and other concerned research units have established stable, man-made ecological systems and have launched a great deal of scientific research work. For example, the Plant Physiology Institute, the Forestry and Soil Science Institute, the Beijing Botanical Garden, the South China Botany Institute and the Jiangsu Botanical Garden have been conducting research on pollution-resistant and sensitive plants for the past several years. They have sifted out a group of trees, flowers and plants with strong pollution-resistant properties and supplied them to cities and industrial and mining districts for use in landscaping. Many localities are giving close attention to landscaping industrial and mining districts, scenic spots and traffic routes. Afforestation with mixed forests, such as coniferous and broad-leaved species or arbor, shrub, leguminous and nonleguminous species is recommended. The Northwest Soil and Water Conservancy Institute, in cooperation with Shaanxi Province, planted strips of "Shadawang [3097 2029 2489]" forage grass, Chinese pine and lemon by aerial sowing and achieved success in effectively controlling water and soil erosion. Forestry departments actively supported the afforestation of the west-central plains region, and within the "Sanbei" shelter forest system every country has newly added planting machines. The Ningxia Bureau of Agriculture and Reclamation has recently been successful in the trial-production of a trenching and planting machine that can plant 1,200 trees per hour. Study of the breeding of fast-growing, high-yield tree species has become a crucial state research problem.

China is also rich in living resources: nationwide there are 30,000 species of higher plants, 3,000 species of vertebrates and 2,145 species of birds. Protection and rational utilization of living resources has a tremendous effect on the environment. China has adopted protective policies for more than 300 species of rare plants and 46 species of nationally protected animals. As of now, 106 conservation areas have been designated and established.

In addition, energy exploitation policies that alleviate pollution, regional comprehensive prevention and control policies for the environment and policies to turn urban sewage into a resource are also very important.

China's environmental protection work was initiated at the beginning of the 1970's. Her 32-word environmental protection policy of "comprehensive planning and rational distribution; multipurpose use of resources and transformation of the harmful into the beneficial; reliance on the masses and participation by everyone; environmental protection and enrichment of the people" was put forward by the Chinese delegation to the 1972 Stockholm Conference. The State Council in 1973 convened the First National Conference on Environmental Protection, where they formally ratified the

above policy and formulated some principles and methods of environmental protection. The past 10 years of practice testify that this policy formulated by the central authorities is correct. Under the guidance of this policy, all levels of government from the national to the local have successively formulated a series of concrete policies, measures, regulations, standards and so forth. Based on a great quantity of environmental protection work and scientific environmental research work, they are just in the process of forming the eight major scientific and technical environmental protection policies as stated above. In short, China's scientific and technical environmental protection policies are in the process of step-by-step maturation. In order to advance this process, we should strive to develop research into scientific and technical environmental protection policies. This work has only just begun in China.

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ENVIRONMENTAL QUALITY

ENVIRONMENTAL INSPECTION DELEGATION ARRIVES IN HAINAN

HK011104 Haikou Hainan Island Service in Mandarin 0400 GMT 1 Feb 85

[Text] The five-member environmental scientific investigation delegation led by (Wang Wenxing), vice president of Chinese Academy of Environmental Sciences, has arrived in the district for an on-the-spot inspection and for selecting protection methods.

The delegation will conduct the inspection in connection with environmental scientific cooperation and the work of airport environmental protection measures, which was proposed by China's Environmental Protection Bureau and the U.S. Environmental Protection Agency.

CSO: 4008/208

ENVIRONMENTAL QUALITY

GUANGMING RIBAO REVIEWS BOOK ON CHINA'S ENVIRONMENT

HK250802 Beijing GUANGMING RIBAO in Chinese 18 Jan 85 p 3

[Article by Xi Chengfan [1598 2110 5672]: "Developing What Is Beneficial and Removing What Is Detrimental--Commenting on the Book 'The Bad Earth--Deterioration of China's Environment'"]

[Excerpts] In 1984, Harper Publishers in the United States published a new book entitled "The Bad Earth--Deterioration of China's Environment." The book is authored by Smil, professor of geography at the University of Manitoba, Canada. The book was written on the basis of the author's study of articles on China's environment published in Chinese and foreign journals between 1979 and 1982.

The author is a geographer. The title of the book, "The Bad Earth," suggests that it is the result of careful consideration. "Bad Earth" is a term used to refer to the kind of rugged, much-dissected land with many trenches, gullies, and so on but with little vegetation. This kind of land exists in China as well as in other countries. It is not an extraordinary phenomenon. What is strange is that the term is used to describe the whole of China. In addition, in his preface to the book, the author states: "China is the country that is suffering most from it." This can only remind us that for more than a century, out of their misunderstanding of China or some other intentions, Western scholars have described old China as being poverty-stricken, backward and hopeless.

Why was old China backward and poverty-stricken? Why did it allow itself to be trampled upon? And why was it reduced to the status of a semi-colony? Both the protracted feudal rule and foreign aggression contributed to all this, which in turn led to the serious disruption of our natural resources and frequent droughts and floods. Consequently, the masses lived in dire poverty.

The birth of New China has brought hopes and made possible the rejuvenation of China's natural resources and environment. However, we must acknowledge that in the 30 years or more following the founding of the country, particularly during the 10 years of turmoil, because science and technology were poorly developed in our country and because of our lack of experience in the exploitation and utilization of natural resources, we made some mistakes in formulating agricultural policies. This resulted in a series of urgent problems concerning the country's environment.

Since 1978, our newspapers and periodicals have openly discussed the problems resulting from our past mistakes. This shows that we have the courage to summarize experiences and to expose our weaknesses and that we are capable of fruitfully exploiting our natural resources and improving the environment.

China is a big country with many natural resources which have been transformed by production. Even those who have devoted much time to doing research in this field will find it difficult to fully understand the situation. The author of this book has only summarized the discussion materials available during a certain period. This superficial approach can only lead to biased conclusions. Following are some of the problems which I would like to discuss with the author of the book.

In the 1930's, serious soil erosion occurred in the United States. As a result of the efforts devoted by scientists in conducting research and experiments and in transforming the soil, things have improved very significantly. The Thames River in England was once very seriously polluted. As a result of scientific research, legislation, and other ways devised to bring about improvements, schools of fish have returned to the river. China's area is equal to that of the United States or that of the whole of Europe. Can we, just because human activities have produced environmental problems, call China a piece of "bad earth?"

Production and other human activities have taken place on Chinese soil for 5,000 to 6,000 years. In the past it sustained the lives of an almost infinite number of Chinese people. China's present population accounts for one-quarter of the world's total population. In the future, China will be nurturing an even greater number of new people. We will unremittingly try to understand China's natural potential and fully and rationally exploit and utilize them. China has an extremely bright future.

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ENVIRONMENTAL QUALITY

PROTECT ENVIRONMENT DURING DEVELOPMENT OF NUCLEAR POWER

Taiyuan FUSHE FANGHU [RADIATION PROTECTION] in Chinese No 5, 10 Sep 84
pp 362-364

[Article: "Exploiting Nuclear Energy From the Environmental Protection Point of View"]

[Excerpt] Conclusion and Discussion

Because people pay great attention to environmental and radiation protection at nuclear power stations, and set much stricter standards of environmental and radiation protection and invest much greater manpower and material resources than conventional industries, develop more scientific research and adopt a series of effective measures on material and management techniques, the potentially dangerous nuclear industry has become a safe industry compared to other industries. Nuclear energy is a clear energy source compared to other energy sources using conventional minerals. Compared to man's dose burden from other radiation, the dose burden produced by radioactive discharge from a nuclear power station is quite low. The dose rate thus discharged has been controlled within the fluctuating range of the dose rate of natural background radiation in the respective areas. It is estimated in the year 2000 with China's planned development of nuclear power stations, the collective dose-equivalent commitment then discharged by the fuel cycles will be only 1.3 100,000 of the annual collective effective dose equivalent from the natural background radiation.

Compared to a coal power station, a nuclear power station has a much smaller impact on the environment. Preliminary estimates show that the radioactive discharge from China's present coal power stations may be higher by more than one order of magnitude than that in developed countries. If in the future the quantity of radioactive discharge by the completed nuclear power stations is at the level of the 1970s in foreign countries, China's present coal power stations, from the viewpoint of radiation damage alone, may cause higher radiation damage. Hence, more nuclear power stations are advantageous from the viewpoint of environmental protection.

Since nuclear energy sources have been shown to be a clean source in science and practice, the general public should accept nuclear energy more readily

than other forms of energy. However, many people still have doubts about the safety of nuclear energy sources; good safety records are consistently held to be suspect. Even the adoption of steadily improving safety techniques and practices does not bring about a change in this attitude. The reasons for this situation are as follows: the damage level acceptable to people is not only a scientific, but also a sociological problem. The fear people have of "nuclear" is long, primarily because most people heard about "nuclear" for the very first time in relation to nuclear weapons. It is inappropriate to regard nuclear power reactors on a par with nuclear weapons. Therefore, we have to energetically stress publicity by correct scientific persuasion to change people's incorrect fear of nuclear power reactors. However, we also know that the nature of radiation biological effect is not completely understood. The impact of radiation on the aquatic ecosystem needs further study. In addition, this fear of nuclear power stations cannot disappear within a short period. So we must take a very cautious attitude to the problem of environmental protection in building and developing nuclear power stations. We need to conduct extensive study and analysis on the causes and underlying background of anti-nuclear groups abroad; useful experience and lessons can be obtained. We have some experience in building and operating reactors but no experience in building and operating nuclear power stations. Only with good records of environmental safety of a constructed and operated nuclear power station in China, can we then gradually wipe out the people's fear of nuclear power. Any major accident caused by China's first-generation nuclear power stations that affect the environment can have a long-lasting deep influence on our development of nuclear power. Hence, in today's China with the advent of nuclear energy, it is imperative to double and redouble our efforts in carrying out the following tasks:

1. Establish and strengthen a management work system of environmental protection, safety and radiation protection at nuclear power stations. The present Environmental Protection Law stipulates a regulation on environmental impact statements; this is advantageous in promoting environmental protection work at nuclear power stations. However, a safety and management system for nuclear power stations has not been formed, such as a safety analysis report.
2. Work out an assessment of the energy source environment and the nuclear environment. Assessment of the environment is a vital part of energy source assessment. This is significant in determining China's policy on energy, improving environmental quality, and developing nuclear energy. The assessment of the nuclear environment is a weak link in the present environmental protection of the nuclear industry; this is also the key link for the study of environmental protection for the nuclear industry. Without the environmental assessment, environmental management lacks a basis, and there is no clear target for environmental control, and there is no way to carry out an analysis on environmental economics. Without a scientific quantitative description of environmental protection of China's nuclear industry, it is difficult to dispel the people's fear of nuclear power.
3. Set up a system for studying nuclear environmental economics. The study of nuclear environmental economics is how to effectively utilize limited

nuclear energy funds for nuclear environmental protection. The main problems to be studied are: (a) Conduct an optimization analysis of radiation protection and determine the optimal figure of expenses for nuclear environmental protection. (b) In studying the effect of costs, investigate how to have the optimal benefits for the fund that has been set aside for environmental protection. In order to solve the above-mentioned problems, first it is necessary to analyze the effect of costs of the present protection facilities of the nuclear industry to summarize experience and increase the fund benefits and provide a basis for further study of the impact of critical costs.

4. Intensify research on environmental standards. China's "Regulations on Radiation Protection" issued in 1974 do not meet the requirements of nuclear power stations. There are obvious problems in some articles: for example, adoption of a concentrated control standard for radioactive discharge, instead of combining dose equivalent, total discharge and concentration with emphasis on dose equivalent and total discharge as the control standard. At present, the theme of environmental standard to be studied is how to apply (in nuclear environmental protection work) the rationally achievable principle of the lowest possible environmental protection.
5. Intensify research on the weak links of environmental monitoring, primarily (a) methods to monitor effluent including chimney and waste-water monitoring, (b) monitoring methods to meet emergencies, and (c) highly sensitive techniques of on-site monitoring.
6. Basic research on the development and environmental protection of nuclear power stations, primarily (a) research on impact of discharge from nuclear power stations on the aquatic ecosystem, (b) research on environmental background radiation. This serves to define a baseline of the natural background radiation level and has great meaning to formulate environmental standards, and (c) transfer patterns of radioactive nuclides in the environment.
7. Research on the disposal of highly radioactive wastes. Safe disposal of highly radioactive waste is a problem of common concern; it must be dealt with as early as possible.

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ENVIRONMENTAL QUALITY

AIR POLLUTION POSES HEALTH HAZARDS TO BEIJING RESIDENTS

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 6, 1984
pp 16-19

[Article by Tai Qisheng [6733 0796 3932]: "Sources of Air Pollution in Beijing and Solutions"]

[Text] How much damage air pollution can do to human health depends on the characteristics of the pollutants, contact methods and the amount of contact. The so-called contact, (or exposure) indicates the amount of a specific pollutant that finds its way into a particular human organ. The total human contact is all the pollutants in the total amount of air inhaled by an individual in a fixed period of time (a day, a month or a year). This includes both outdoor and indoor air pollutants. The amount of total daily contact with a particular pollutant can be measured with the aid of a portable atmospheric monitoring device. Alternatively, it can be estimated by using a mathematical model based on the pattern of human activity. For instance, we can find the concentrations of pollutants in the living and working environments of a person and average them out over a period. We will then end up with the weighted average of concentration he is exposed to. This article suggests some ways to reduce the total amount of contact with air pollutants, with reference to the air pollution situation in Beijing and the characteristics of human exposure to pollutants.

1. Major Air Pollutants in Beijing

Air pollution in the Beijing area is primarily caused by the burning of coal. The suburbs (which account for 5 percent of the area of the entire municipality) account for about 80 percent of total municipal coal consumption and 90 percent of total civilian coal consumption. Consequently, smoke, dust, sulfur dioxide and carbon monoxide, all by-products of coal burning, are the principal air pollutants in the municipality.

Long-term low-concentration exposure to sulfur dioxide can damage the functioning of the respiratory tract and lungs and cause various respiratory illnesses. When the daily concentration of sulfur dioxide exceeds 150 micrograms per cubic meter, the condition of bronchitis

patients worsen noticeably. When the concentration reaches 200 micrograms per cubic meter, the functioning of the lungs of primary school pupils may slow down. At a level of 300 to 500 micrograms per cubic meter, the hospitalization rate of elderly sufferers of respiratory diseases will rise. An annual sulfur dioxide concentration of over 100 micrograms per cubic meter poses a threat to human health, as indicated by the doubling of the incidence of such respiratory illnesses as bronchitis compared to a non-polluted environment. To protect public health, the World Health Organization (WHO) has set the sulfur dioxide exposure limits at 15-micrograms per cubic meter for average daily exposure, and 40 to 60 micrograms per cubic meter for average annual exposure. Measured against these standards, the sulfur dioxide concentration in our city is excessively high. Sulfur dioxide concentrations in various suburban locations also exceed the WHO limit of 150 micrograms per cubic meter by 30 to 50 percent. Their average annual concentrations are also higher than the WHO standard of 60 micrograms. Some densely populated residential areas and commercial areas with decentralized heating have recorded an average annual concentration as high as 100 to 150 micrograms per cubic meter, which is twice what the WHO allows.

Smoke and dust pollution constitutes another major hazard to public health. A good indicator of the extent of their damage is the amount of fly ash in the air. When fly ash concentration tops 700 micrograms per cubic meter and that of sulfur dioxide reaches 715 micrograms per cubic meter, the number of deaths from respiratory illnesses will rise. When the concentrations of these two pollutants reach 2,000 micrograms and 1,500 micrograms per cubic meter respectively, the mortality rate among residents will increase by 20 percent. Based on research in some countries, the WHO has set standards for daily exposure at 150 to 230 micrograms per cubic meter and long term average annual exposure at 60 to 90 micrograms per cubic meter. Again, the concentrations of fly ash throughout our municipality do not meet these standards. Granted, local fly ash contains a large amount of natural dust because of the sand blown here by wind, our low afforestation rate and our limited water surface. But even if we discount one third of the fly ash as natural dust, the remaining concentration is still way above the WHO limit value. Fly ash concentrations in urban areas and in suburban industrial districts all exceed WHO limits by 1 $\frac{1}{2}$ times.

The hazards of carbon monoxide are well known. The WHO has not proposed a clear safety standard for exposure to this pollutant while standards imposed by different countries also vary. Some countries have set a short-term 8-hour exposure limit of 6 milligrams per cubic meter. Carbon monoxide pollution is also a serious problem in Beijing. It is worst in busy traffic intersections, commercial areas, shopping areas with decentralized heating and other public places where the concentration can reach 2 to 5 milligrams per cubic meter in summer and 5 to 10 milligrams in winter. In winter, concentrations in poorly ventilated offices, houses and shops which burn coal for heating purposes may go up to 15 to 30 milligrams per cubic meter.

II. Characteristics of Exposure to Air Pollutants in Beijing

(A) In any one day, most of the exposure to air pollutants occurs in the morning and at night. The three main air pollutants in the city derive from both domestic and industrial activities. The domestic consumption of coal creates a widespread pollution hazard.

There are two pollution peak periods, from 6 a.m. to 9 a.m. and from 5 p.m. to 8 p.m. This is because of the occurrence of inversion in the morning and at nightfall, an meteorological phenomenon unfavorable to the rapid dispersal of air pollutants. Moreover, residents tend to burn more coal and drive more in these hours, discharging more exhaust fumes and other emissions into the air. The peak concentrations of sulfur dioxide and carbon monoxide exceed their daily averages by 3 to 5 times and 2 to 3 times respectively. In the case of fly ash, the increase ranges from half to one fold.

Mornings and evenings, too, are the periods when carbon monoxide, sulfur dioxide and dust are at their highest levels indoors. Indoor pollutants only partly come from the air outside. They also result from such activities as cooking, home heating and the use of coal and liquefied petroleum gas. Consequently, indoor air pollution is often at its worst when residents prepare meals. Air pollution, whether indoor or outdoor, reaches a peak when human activity is at its busiest. The amount of pollutants inhaled during such periods makes up a relatively high portion of the total amount of pollutants absorbed for the entire day.

(B) Exposure to air pollutants is more extensive in winter. Both indoor and outdoor air pollution markedly increase in Beijing between November and the following March and gets worst in the bitterly cold months of December and January. The winter concentration of sulfur dioxide is 10 to 16 times higher than in summer. Corresponding increases for carbon monoxide and fly ash are 2 to 3 times and 1 to 2 times respectively. In the home-heating season of winter, there are 5 to 10 times more carbon monoxide indoors than outdoors. The concentration of sulfur dioxide in homes heated by coal-burning furnaces exceeds its outdoor counterpart by 1 to 2 times. Because of higher smoke pollution in winter, the concentration of benzo(a) pyrene, a carcinogen in fly ash, is 3 to 5 times higher than in summer. It is estimated that Beijing residents inhale as much benzo(a)pyrene in winter as they do in summer and fall combined. Their winter exposure to lead also doubled that of summer.

(C) Exposure to indoor pollutants exceeds that of outdoor pollutants. Gas and central heating are not in widespread use in the city. Moreover, most public places, including shops, hotels, movie houses are poorly ventilated. There are fewer than 150,000 gas-consuming households in the municipality and only 6 million square meters are supplied with heat from a central heating and power plant. People mostly depend on coal for cooking and home heating purposes. Although there are currently 730,000

households which use liquefied petroleum gas as a cooking fuel, they remain dependent on coal to heat their homes. Hence the serious indoor air pollution problem. Furthermore, the burning of liquefied petroleum gas creates nitrogen oxide, carbon monoxide and lampblack in large quantities, with considerable adverse effects on the quality of air indoors. Households which cook and heat their homes by burning coal or liquefied petroleum gas all suffer higher concentrations of carbon monoxide and sulfur dioxide than outdoors. When doors and windows are tightly shut and ventilation is low, the level of carbon monoxide can reach 15 to 30 milligrams per cubic meter, 5 to 10 times higher than outside. In shops, factories and offices which burn coal to heat their premises, the sulfur dioxide and carbon monoxide concentrations rise significantly higher than outside, reaching 500 micrograms and 50 milligrams per cubic meter respectively. When someone smokes indoors, the concentrations of carbon monoxide and fly ash increase noticeably. It is estimated that a passive smoker can inhale as much benzo(a)pyrene in six hours in a smoke-filled room as one would inhale outdoors in an entire year. It can thus be seen that passive smokers must be counted among the victims of cigarette smoke pollution.

(D) People living in densely populated areas with decentralized heating suffer greater exposure to air pollution than residents elsewhere. Air pollution monitoring conducted indoors and outdoors shows that among the various types of areas in the municipality, urban residential areas have the most serious air pollution problems, followed by commercial and industrial areas. And among residential areas, those with large populations and decentralized heating fare the worst. Residents who use coal to cook and heat their homes live in a smoke polluted environment year round.

(E) Workers who bicycle to and from work on crowded streets are perennially subject to exhaust fumes emitted by Beijing's 120,000 automobiles. The vehicular traffic flow at major intersections during rush hours is 2,000 vehicles per hour. Exhaust fumes discharged by automobiles contain more than 100 hazardous substances, including sulfur dioxide, carbon monoxide, nitrogen oxide, hydrocarbon and fly ash in particles small enough to enter the human body. This type of fly ash contains more benzo(a)pyrene than smoke and dust in general. The concentrations of those pollutants near the city's main communication lines are higher than elsewhere. When pollution is at its worst, carbon monoxide and hydrocarbon concentrations are 10 to 30 milligrams per cubic meter and 300 to 700 micrograms per cubic meter respectively, which are 1 to 4 times higher than the standards in Japan. Some studies have pointed out that after working four hours, traffic policemen and store sales staff in areas with the highest traffic volume experience a noticeably higher blood concentration of carboxyhemoglobin than when they began their working day. Clearly workers who bicycle to and from work every day and find themselves behind cars emitting exhaust fumes are most exposed. Such fumes account for a large percentage of the total amount of carbon monoxide and benzo(a)pyrene they inhale every day.

III. Ways to Reduce Exposure to Air Pollution

(A) We must clarify our objectives and make a concerted and united effort to eliminate the "three wastes."

We can see from above that air pollution in Beijing derives from three main pollutants, dust, carbon monoxide and sulfur dioxide, whose combined annual emission amounts to 1.1 million tons. To prevent air pollution, we must hit out at these three sources. Our targets are the municipality's more than 1,000 factories, 100,000 automobiles and the stoves and furnaces used by millions of households. The elimination of the "three wastes" requires a joint effort to which everybody must contribute.

(B) Our heat supply methods and fuel mix must be changed. Air pollution is essentially caused by our outdated heat supply methods and irrational fuel mix. We must firmly deal with the practice of each family having its own boiler. To begin with, we should introduce central heating in commercial districts and densely populated areas and gradually get rid of short chimneys. New buildings must be required to install central heating. If they cannot afford it, they must build higher chimneys to facilitate smoke dispersal. Heating and power plants should be built in the suburbs to reduce the amount of urban pollution.

We should also change our fuel mix by using liquefied petroleum gas instead of coal for cooking purposes. Before we can all switch over to gas as a cooking fuel, we should supply residents with low-sulfur, high-grade coal and popularize advanced coal-burning technologies and fuel-efficient kitchen stoves to prevent air pollution.

(C) Various measures should be taken to reduce air pollution caused by traffic. In planning the city's transportation system, we must put dual emphasis on the tram and the automobile, establish new tram routes, increase the share of passenger traffic of the tram and develop the trolley bus which is fast-moving and carries more people. To reduce air pollution over main traffic arteries, we should open up new tram routes parallel to those arteries as a way of distributing traffic volume rationally. Automobile technology must be improved to build less polluting cars. Without compromising road safety, we should try to raise driving speeds to reduce the amount of carbon monoxide and sulfur dioxide discharged. Positive efforts should be made to research and manufacture a cleaning device for automobile emissions. We must formulate automobile emission standards and strengthen our management of air pollution created by traffic. We should make full use of the subway to ease pressure on the bus.

(D) We should step up tree planting in the municipality and let trees act as a cleaning agent. Since afforestation has significant implications for reducing human exposure to air pollutants, more trees should be planted, not only on roads, streets and along river banks, but also in such densely populated and highly polluted areas as residential districts, commercial areas and in the compounds of factories, offices and schools.

Afforestation should be included in the environmental protection plans of localities and departments. We should encourage the public to take up tree planting on a large scale and implement the "three guarantees." We should make demands, set a time frame and strengthen afforestation leadership and management.

(E) Every way must be found to reduce indoor air pollution, which results from such indoor activities as cooking, smoking and home heating as well as migrating from outside. Since residents spend most of their time indoors, it is extremely important that we reduce their exposure to indoor air pollution. Central heating, the replacement of coal by gas as a cooking fuel and increased afforestation are all useful in this regard.

Smoking is a major factor for air pollution in residences, offices, shops and clubs. When several people light up at a meeting, carbon monoxide and fly ash concentrations in the room can reach 70 milligrams and 200 micrograms per cubic meter respectively. In a regular residence, if one person smokes, the concentration of carbon monoxide can go up to 15 milligrams per cubic meter while that of fly ash doubles what it would be in a house where no one smokes. When two people smoke, the carbon monoxide concentration would go even higher to 20 milligrams per cubic meter. The concentrations of carbon monoxide and fly ash in an office where people smoke can be 3 to 5 times and 1 to 2 times higher compared to an office where no one smokes. In public places, e.g., shops and reading rooms, which are poorly ventilated, smoking can result in a carbon monoxide concentration which even exceeds those in offices and residences. As a result, an all-out effort must be made to publicize the dangers of indoor smoking and a system must be set up to forbid smoking in public places. Also, good air circulation and damp cleaning practices can help reduce indoor air pollution.

(F) There should be a functional re-ordering of the city by which we can gradually reduce the population density and the excessive number of factories in the urban areas. Also to be slowly transformed is the cheek-by-jowl distribution of factories and residences. Factories should not be allowed in densely populated areas. One-story houses should be pulled down in a planned way. More trees should be planted. Street industries should be moved out of residential areas and more satellite towns should be built.

(G) Workers' commuting routes should be shortened. We should try to bring people closer to their workplace or school through a program of job- and quarters-switching.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

BRIEFS

INFORMATION TECHNOLOGY INSTITUTE OPENS--Beijing, 30 January (XINHUA)--The Beijing Information Technology Institute, the first of its kind in China to train workers specialized in electronics and information technology, was opened today. The institute will offer six courses--Computer Application, Software Science, Telecommunications Engineering, High-Precision Electronic Machinery, Information Management Systems and Industrial Management Engineering. Institute President Yang Tianxing told XINHUA that more than 200 students would be enrolled this year, while postgraduates would account for 20 percent of its planned 3,000 students by 1990. American and Japanese professors would be invited to give lectures. The institute is aimed at strengthening China's electronics and information industries. [Text]
[Beijing XINHUA in English 1500 GMT 30 Jan 85 OW]

CSO: 4010/78

PUBLICATIONS

BRIEFS

ELECTRONICS, COMPUTER JOURNAL ANNOUNCED--Publication of DIANZI YU DIANNAO [ELECTRONICS AND COMPUTERS], China's first scientific magazine for popularizing knowledge about microcomputers and computers, started on 4 February. Run by the Ministry of Electronics Industry, the magazine will provide an opportunity for young people to learn microcomputer science and modern scientific management. [Summary] [Beijing Domestic Service in Mandarin 1100 GMT 5 Feb 85 OW]

CSO: 4008/219

AUTHOR: HUANG Qixiang [7806 0796 4382]

ORG: Research Institute of Surveying and Mapping

TITLE: "The Effect of Error in the Earth Polar Coordinates on the Orientation and Scale of Triangulation Chain"

SOURCE: Beijing CEHUI XUEBAO [ACTA GEODETICA ET CARTOGRAPHICA SINICA]
in Chinese Vol 13 No 3, Aug 84 pp 204-208

TEXT OF ENGLISH ABSTRACT: In accordance with the specified accuracy requirement of the astronomical determination of latitude, longitude and azimuth, this paper discusses the effect of error in the earth polar coordinates on the orientation and scale of the triangulation chain by passing through its effect on astronomical latitude, longitude and azimuth. On the basis of this discussion, the necessary accuracy in the determination of earth polar coordinates ($m_x = m_y \leq 10.061''$) is derived.

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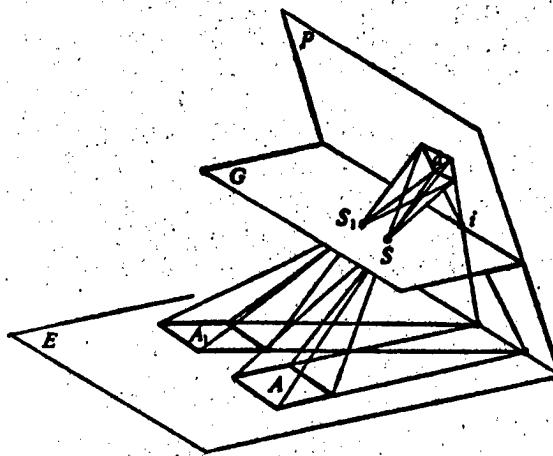
ORG: All of Wuhan Technical University of Surveying and Mapping

TITLE: "Affine Rectification of the Landsat MSS Images by Means of a Photogrammetric Optical Rectifier"

SOURCE: Beijing CEHUI XUEBAO [ACTA GEODETICA ET CARTOGRAPHICA SINICA] in Chinese Vol 13 No 3, Aug 84 pp 209-215

TEXT OF ENGLISH ABSTRACT: The rectification of satellite imagery by means of a photogrammetric optical rectifier has been widely used in many institutions of China, but the rectification accuracy is usually not quite satisfactory. This is mainly due to the fact that affine deformation of the images can not be efficiently corrected when using this method.

In our experiment a two-stage rectification scheme on a rectifier is tested which can successfully correct the image affine deformation. The resulting accuracy amounts to 135 m on the ground. This method is now being applied in the investigation of the area change of Jiang-Han Lake District in Hubei Province.



Principle of two-stage affine rectification

9717

CSO: 4009/91

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TITLE: "Cloning Fragments of EBV-DNA in Single-stranded M13mp8. II. Preparation of a Very Sensitive Hybridization Probe"

SOURCE: Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese No 5, Oct 84 pp 281-285

TEXT OF ENGLISH ABSTRACT: Fragments of EBV-DNA were inserted into M13mp8 phage DNA. A sensitive and effective probe was obtained for hybridization. Here we describe the preparation of the primer which is used to detect synthesis of the vector DNA strand and leaves the inserted fragment single-stranded, the synthesis of the labeled probe and hybridization results.

AUTHOR: LU Pingcheng [7120 1627 2052]
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TITLE: "Transfer of Immunity Against Candida Albicans Infection with Immune-RNA"

SOURCE: Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese No 5, Oct 84 pp 315-317

TEXT OF ENGLISH ABSTRACT: The present study reveals that immune RNA (iRNA) extracted from lymphoid tissues of mice immunized with C. albicans can transfer immunity against C. albicans infection. Following incubation with iRNA, migration of leukocytes separated from the peripheral blood of mice and human cord blood was inhibited in the presence of cytoplasmic antigen of C. albicans. Normal mice receiving iRNA could produce delayed hypersensitivity to the C. albicans antigen and were definitely more resistant to the systemic C. albicans challenge, as verified by the two-week survival rate and the inhibition of bacterial growth in the kidneys. We are of the opinion that iRNA might be of use in the treatment of C. albicans infection.

9717
CSO: 4009/83

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TITLE: "Clinical Observation and Preliminary Study of Termination of Early
Pregnancy by Administration of Yellow Daphne"

SOURCE: Shanghai SHENGZHI YU BIYUN [REPRODUCTION AND CONTRACEPTION]
in Chinese No 4, Nov 84 pp 42-46

TEXT OF ENGLISH ABSTRACT: Seventy-four cases of early pregnancy with periods
of amenorrhea of 36-69 days from the last menses were terminated by using a
single dose intra-uterine instillation of Wikstro-Emia Chamaedaphne Meish
Alcohol Solution (WCMAS). They were divided into three groups according to
the dosages used: 0.2 gm, 0.4 gm and 0.6 gm of WCMAS. The efficacy of the
different dosages was evaluated.

The most successful in the termination of early pregnancy (fewer than 56 days)
was the 0.4 gm group, with the rate of effectiveness being 96.6 percent, and
the complete abortion rate being 93.3 percent. The average duration of
complete abortion in all was 21.3 hours, and the average duration of vaginal
bleeding was 10.9 days. Although the amount of bleeding was regarded as a
little greater than that of normal menstruation by some patients, no serious
side effects occurred except for some subjective lower abdominal pain and
vomiting in some patients.

Serum hCG and progesterone were determined by radioimmunoassay technique in
31 cases, and it was found that the hCG and progesterone levels both declined
rapidly in 12 hours and fell to 35.5 percent and 46.4 percent respectively
24 hours after injection.

Under microscopic examinations necrotic degeneration was observed in most
of the chorionic villi, and marked necrosis and hemorrhage in the decidua.
The granulocytes in the decidua also decreased in amount.

Forty-eight cases were followed up recently; no side effects were found and
there was no interference with re-pregnancy.

9717

CSO: 4009/90

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TITLE: "The Geochemical Studies of U, Th, Ra, K(⁴⁰K) in Sediments of Okinawa Trough"

SOURCE: Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese No 5, Sep 84 pp 457-467

TEXT OF ENGLISH ABSTRACT: The determinations and geochemical studies of U, Th, Ra, K(⁴⁰K) in sediments of the Okinawa Trough were carried out with an 8180-4K multichannel Ge(Li) γ spectrometer in 1981. The region of the investigation is located at 124-129°E and 26-31°N. The mean concentrations of U, Th, Ra, and K(⁴⁰K) are 2.18 ppm, 8.76 ppm, 9.58×10^{-13} g/g and 1.85×10^{-2} g/g (or 15.53 pCi/g) respectively. The concentrations and ratio of uranium and thorium in sediments of the Okinawa Trough are similar to those in the sediments of the Huanghai Sea, Bohai Bay and the continental shelf in the East China Sea, as well as the terrestrial materials in China. This shows that there are close relationships between the Okinawa Trough and the shelf of the East China Sea.

The distributions of U, Th, Ra, K(⁴⁰K) are related to their physical-chemical properties, redox state, biotic activation and the deposition of the biotic debris and grain size of the sediments in the Okinawa Trough.

The distribution of Uranium is remarkably affected by the redox state in this region. The changing of its valence from six to four and deposition from seawater to sediment would take place in the above environment.

The contents of Th, K, and Ra increased gradually from the outer to inner region of the Okinawa Trough with the increase of clay components and the decrease of grain size.

9717
CSO: 4009/89

AUTHOR: LI Luping [2621 7120 1627]

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TITLE: "Research on the Estimate of Spectra for Non-stationary Wave Processes"

SOURCE: Qingdao SHANDONG HAIYANG XUEYUAN XUEBAO [JOURNAL OF SHANDONG COLLEGE OF OCEANOLOGY] in Chinese No 4, 15 Dec 84 pp 13-26

TEXT OF ENGLISH ABSTRACT: In this paper some important constraints in the optimal design relations for the non-stationary wave field, developed by Tayfun et al., are discussed. Both spectral bandwidth parameters, $B_f(t,\omega)$ and $B_o(t,\omega)$, are derived on the basis of the developing wind wave spectra, regarded as time-dependent theoretical spectral densities $S(t,\omega)$, and their roles in the optimal design of estimates are emphasized. The criterion for the optimum choice of evolutionary power spectra is proposed. The procedure for determining the spectral bandwidth $B_o(t,\omega)$ from a single wave surface record is simplified and a method for obtaining the optimal design relations is presented. For nonhomogeneous wave fields in shallow water, an approach is developed for the spectral estimate which may be termed the most accurate available from the data.

9717

CSO: 4009/88

Physics

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ORG: Southwestern Institute of Physics

TITLE: "Status of Research on Plasma-surface Interaction in Tokamaks"

SOURCE: Chongqing HEJUBIAN YU DENGLIZITI [NUCLEAR FUSION AND PLASMA PHYSICS]
in Chinese Vol 4 No 1, 15 Mar 84 pp 1-10

ABSTRACT: The status of research on plasma-surface interaction in tokamaks was described and 43 references were cited. In the next generation of tokamaks and fusion reactors, the plasma-surface interaction will be very vigorous. In the area of plasma edge physics, various flow models and kinetic models have been developed. However, the fundamental physical process in the plasma edge is not well understood yet. A comprehensive model still does not exist. Several models for the full particle-recycling process were discussed. The formation mechanism of impurities was described. Such impurities should be controlled by the rapid removal of impurities and the minimization of their formation. Furthermore, various diagnostic techniques were introduced. The requirements of the first wall materials were also listed. It is commonly believed that a titanium carbide coating is the ideal material. Finally, several general requirements for future fusion reactors were outlined as follows:

1. The particle energy at the plasma-wall interface should be low in order to weaken the plasma-wall interaction and to reduce the release of impurities.
2. The shielding efficiency against impurities and high energy particles must be high in order to maintain the purity of the plasma and to minimize damage to the wall.
3. The thermal flux from the plasma discharge should be homogeneously distributed over a large area to reduce the thermal load on the wall.
4. Particle recycling must be rigorously controlled to control the plasma density effectively.
5. Helium ash from the reactor must be rapidly exhausted.

12553

CSO: 4009/24

Physics

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TITLE: "Measurement of Ion Temperature in Mini-torus Plasma by Doppler Broadening"

SOURCE: Chongqing HEJUBIAN YU Dengliziti [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 4 No 1, 15 Mar 84 pp 18-23

ABSTRACT: Measuring ion temperature by Doppler line broadening has become a diagnostic technique in some tokamaks. In this work, a rotating mirror-scanning spectrometer was used to obtain the scanning spectra and transient profiles of the H_{α} and H_{β} lines of the hydrogen plasma in a mini-torus during discharge. The Balmer series was chosen for this small device because its Zeeman effect was negligible as compared to the Doppler broadening width. It was noticed that the spectrum was formed by two Gaussian profiles which reflected the temperature difference between the edge and the center of the plasma. The profile of the H_{α} and H_{β} spectra lines was asymmetric and only the longer wavelength side was Gaussian. The accuracy of $\delta\lambda_D$ greatly affected the results. Factors affecting the accuracy of $\delta\lambda_D$ included: (1) the accuracy of the scan rate, (2) the accuracy of the timing marker on the scan and (3) the error in measuring data on reproduced profiles. In addition, the Doppler profile was shifted symmetrically by $2\Delta\lambda_z \approx 0.2\text{\AA}$ with an increasing or decreasing wavelength. This shift led to the thickening of the Doppler profile on the oscilloscope. It was estimated the error of T_i was approximately 20 percent.

12553

CSO: 4009/24

Physics

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TITLE: "Experiments on a Field-reversed Configuration"

SOURCE: Chongqing HEJUBIAN YU DENGIZITI [NUCLEAR FUSION AND PLASMA PHYSICS] in Chinese Vol 4 No 1, 15 Mar 84 pp 36-40

ABSTRACT: Preliminary results were obtained in experiments on a field-reverse configuration in the CF-device. The field-reverse configuration was measured using an end-on framing camera, internal radial magnetic probes and an external axial array of differential magnetic loop probes. The total energy of the CF-1 device was 100 KJ. The glass vacuum chamber was 80 cm long and 25 cm at the outer diameter. The main magnetic coil was 60 cm long and 30 cm in the inner diameter. The bias field was provided by 12 parallel capacitors which were discharged across the main coil through a triple pole spark gap for 400 μ s. Experimental results showed that the establishment of a field-reverse configuration was closely related to the pressure, magnetic field (bias and primary), initial plasma and impurity content. It was found that the field-reverse configuration could be formed easily. However, the ionic capture flux was difficult to control. The typical data of the field-reverse plasma generated in the CF-1 device was: plasma radius 4 cm, length 35-40 cm, and stabilizable beam over 30 μ s. The commonly observed rotational instability at $m=2$ was not found. This might be attributed to the lower temperature and density of the plasma used.

02553
CSO: 4009/24

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TITLE: "Plasma Levels of FSH, LH, E₂-17 β and Progesterone in Normal and Progestin No 1 Compound Tablet Treated Women"*

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 5, 5 Oct 84 pp 483-490

TEXT OF ENGLISH ABSTRACT: Plasma levels of FSH, LH, E₂-17 β and progesterone were RIA determined in 9 normal fertile women and 13 women treated with Progestin No 1 Compound Tablet (3-cyclopentyl propionate of megestrol acetate). The tablet is a new kind of long-acting contraceptive which is given on day 10 (100 mg Progestin No 1-0.5 mg quinestrol) and day 16 (50 mg Progestin No 1-0.25 mg quinestrol) of the cycle. The results showed significant changes in the hormonal profile of the treated group. When compared with the normal value of the hormones in the control group, three patterns of hormonal changes during the menstrual cycle were observed, i.e., anovulatory (nine cases), ovulatory (two cases) and delayed ovulatory (two cases).

In reference to the authors' previous study of the effect of the tablets on the endometrium, possible relevance of the hormonal changes to endometrial prematurity is discussed. According to the results of the present work, it is suggested that the progestational activity of the tablet might have a direct effect on the endometrium to advance its development.

* This work was supported by the Special Program of Human Reproduction, WHO (Geneva).

9717

CSO: 4009/84

TAIWAN

TAIWAN-JAPAN SCIENCE COOPERATION MEETING OPENS

OW181041 Taipei CNA in English 0948 GMT 18 Jan 85

[Text] Taipei, 18 Jan (CNA)--The Republic of China and Japan should further expand the interflow of technological knowhow by initiating more cooperative sci-tech research programs, said K. T. Li, minister without portfolio, Friday.

Li made the remarks while speaking to the opening ceremony of the third joint conference of the ROC's Asia-Pacific Science and Technology Association and Japan's East Asia Scientific and Technological Cooperation Association. The conference opened Friday morning at the Fortune Hotel in downtown Taipei.

Li indicated that the ROC Government has been placing much emphasis on the development of science and technology and devoting a large sum of budgets and manpower to the sci-tech sector. Li then called on the Japanese Government and private industries to extend more support for the ROC to develop high technologies.

The opening ceremony was co-chaired by the heads of the two organizations Chang Kwang-shih and Masao Maeda. Chang said at the occasion that the ROC Government hopes to learn something from Japan's strategies and experiences in the sci-tech development.

Maeda pledged that his association will do its best to help promote ROC's sci-tech development, particularly in the technical manpower cultivation and the initiation of research programs.

Komiyama Shigechiro, a Japanese Dietman and chief delegate of the Japanese association, said that the ultimate goal of the bilateral sci-tech cooperation is to further expand each other's economic development and commercial exchanges between the two countries. He further urged the ROC association to let its Japanese counterpart know what help it expects from Japan.

Over 200 Chinese and Japanese scientists and technological specialists attended the opening session. Many ranking Chinese government officials and nine Japanese Dietmen were also present at the gathering.

The participants will hold panel discussions on the transfer of technology in many academic fields in the afternoon.

CSO: 4010/67